

Technology, Lifeways and Cuisine

A collection of ancient pottery vessels, including a large decorated jar, a smaller jar with a perforated rim, and several small cups, all displayed against a black background.

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CERAMICS IN CIRCUMPOLAR PREHISTORY

Throughout prehistory the Circumpolar World was inhabited by hunter-gatherers. Pottery-making would have been extremely difficult in these cold, northern environments, and the craft should never have been able to disperse into this region. However, archaeologists are now aware that pottery traditions were adopted widely across the Northern World and went on to play a key role in subsistence and social life. This book sheds light on the human motivations that lay behind the adoption of pottery, the challenges that had to be overcome in order to produce it and the solutions that emerged. Including essays by an international team of scholars, the volume offers a compelling portrait of the role that pottery cooking technologies played in northern lifeways, both in the prehistoric past and in more recent ethnographic times.

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CERAMICS IN CIRCUMPOLAR PREHISTORY

TECHNOLOGY, LIFEWAYS
AND CUISINE

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ONE

COLD WINTERS, HOT SOUPS AND FROZEN CLAY

Understanding the Adoption of Pottery Traditions into the Circumpolar North

Peter Jordan and Kevin Gibbs

1.1 INTRODUCTION: THE PUZZLE OF CIRCUMPOLAR CERAMICS

Living in the colder, higher latitudes of the earth has always been difficult, and must have been even more so in prehistory. The combination of harsh environments, strong seasonality and associated risks and uncertainties created many fundamental challenges that humans had to cope with (Rowley Conwy 1999). Despite these obstacles, humans were already making forays into parts of the Eurasian Arctic as far back as 30,000 years ago, and by the end of the Pleistocene had established footholds in the most northerly parts of the Old World. In contrast, apart from Alaska, settlement of higher-latitude North America was delayed by the slower pace of deglaciation. Finally, by around 4,500 years ago, humans had established a chain of circumpolar settlement that spanned the globe, and now included High Arctic Greenland (Friesen and Mason 2016; Hoffecker 2005).

To survive, communities needed to make sure that they were in the right place at the right time of year and that they had the right equipment; circumpolar environments – especially coastal and maritime ecosystems – could potentially offer abundant food and fuel resources. But these resources were often available only during narrow windows of opportunity in the annual cycle. People either needed to move constantly between available food sources or use surplus that they had stored up in one season to deal with the shortfalls

that followed in the next. Sharp inter-annual fluctuations in the size of animal populations added further pressures, as did the repeated environmental shifts caused by fluctuating climates. Finding effective ways to cope with these multiple risks defined the routines of local existence. Survival strategies emerged slowly through the gradual amassing of appropriate skills and knowledge; this cultural repertoire could then be refined, expanded and passed on from one generation to the next.

Such skills and knowledge meant that prehistoric cultures not only survived across the Circumpolar North, but frequently flourished. This involved both demographic expansions into uninhabited areas, as well as absorption or replacement of other cultures. However, these periods of accelerated growth and development were frequently interspaced with long periods of deep continuity, as well as sudden contractions, disappearances and repeated abandonments of remoter regions, especially in the High Arctic. Much of this relentless cultural dynamism appears to stem from the complex intersections between shifting climates and environments, the strategies used for procuring available resources and associated shifts in demography and wider interaction networks. On the ground, these pressures sometimes resulted in communities switching from living in fluid social bands that were highly mobile, through to aggregating into larger, settled communities that were committed to inhabiting specific places. The fragility and resilience exhibited by these circumpolar cultures is what makes the prehistory of the Circumpolar North so interesting; it has some of the most dynamic sequences of human cultural development on the entire planet (Friesen and Mason 2016; Maschner 2015).

From the very moment that humans expanded into northern areas, the use of technology – that is, the cultural knowledge needed to produce and use tools, objects, equipment and other material culture – was absolutely central to existence, both for daily survival, which inevitably required exploitation of wild resources for non-agricultural foragers, but also in the conduct of wider sociocultural and spiritual life. Over time, important new material innovations emerged across the North, while others were adopted from adjacent areas. The centrality of sophisticated tools and equipment to northern lifeways makes the study of technological traditions of central importance. Careful reconstruction of how new skills, tools, knowledge and equipment were created, used and shared, offers archaeologists an ideal entry point into a constellation of interconnected research themes, ranging from ecology, adaptation and human–environment relations, through to technological practice, cultural inheritance and the negotiation of gender and other social identities.

This book deploys exactly this kind of approach; it aims to improve current understandings of one of the most intriguing elements of the northern hunter-gatherer technological repertoire: *pottery*. This is defined as ceramic cooking and storage containers made from fired clay. The prehistoric use of pottery was a

recurrent – but somewhat later – feature of human life across most of the Circumpolar World; at times it was being made and used well above the Arctic Circle (Jordan and Zvelebil 2009), but unlike the lithic traditions that had been there with the first pioneers, the first use of pottery *post*-dates the earliest human settlement of the North. In other words, people had survived for many millennia across the Northern World without ever having known or used pottery. The main question is therefore, what features or benefits of pottery technology made it so attractive, and why was it so widely adopted? To understand this process we need to go further back in time.

These enigmatic northern pottery traditions emerged first in the archaeological record of Northeast Asia at the end of the Pleistocene, just *before* the world emerged from the final sharp fluctuations in climate that marked the end of the last Ice Age. By the mid-Holocene, use of ceramic container traditions had been adopted by hunter-gatherer cultures living across much of northern Eurasia, and were also spreading up into sub-Arctic North America; in most areas, these pottery traditions persisted for hundreds of generations, and in many areas, until European colonial trade networks started to offer access to alternative metal container technologies.

That prehistoric foraging cultures were even using pottery so far north often comes as a surprise to many archaeologists; the presence of ceramics in cold, seasonally frozen landscapes seems simply odd and out of place. For this reason, the complex history of northern pottery traditions has generally been glossed over, and remains under-researched. This is a lost opportunity. In fact, two primary factors have contributed to the enigmatic status of northern pottery. The first is an implicit assumption: compared to many other types of containers, pottery is relatively heavy and fragile, and its use has long been associated with settled farmers, not mobile hunter-gatherers (e.g., Barker 2006: 15). Higher-latitudes were inhabited by prehistoric foragers – not by village-based agriculturalists – and so the use of pottery by these early northern societies seems counterintuitive.

The second reason is much more explicit: as soon as the widespread existence of northern pottery traditions is acknowledged, their dispersal and adoption into Circumpolar ecosystems becomes even more puzzling. This is because pressing environmental constraints at higher latitudes mean that every step of the pottery manufacturing process must have been very difficult, or at least very costly in terms of skills and effort. This alone makes the study of northern pottery all the more interesting – clearly, time was being invested in securing all the necessary resources, ranging from clay sourcing through to gathering fuel for the firing. Moreover, cold northern winters meant that pottery-making must have been a summer craft, but this season can also be one of the busiest times in the annual cycle for obtaining and processing vital food supplies that need to be stored up for the forthcoming winter. Somehow,

pottery-making had to be fitted in alongside all these other pressing tasks. Importantly, pottery technology was also a later cultural phenomenon; it was adopted into a Northern World that had long been settled by diverse foraging cultures. These communities had already developed effective ways of surviving in the North. While none of these survival strategies required pottery, many involved using other cooking and container technologies such as griddle stones, boxes, bags and baskets.

Clearly then, something vital and compelling was making pottery technology attractive to prehistoric northern societies. This enduring value – or specialized function – was so important that it eventually overcame all the high costs and practical challenges of making pots in the North. As this complex acceptance process played out, strategic choices and trade-offs must have been made among individuals living in each and every community. Pottery offered benefits, but maintaining it as an intergenerational cultural tradition demanded that it had to be aligned with all the other preexisting practices, obligations and seasonal activities, all of which competed for available time and effort (see Harry and Frink 2009, Harry et al. 2009).

In this way, the study of northern pottery potentially offers much more than simply mapping arrival dates onto dispersal maps, or even the chance to study how the ceramic craft was integrated into local routines and practices. Some of the most interesting insights start to emerge by examining how the adoption of pottery into the wider technological and sociocultural repertoire of northern societies had cumulative impacts, perhaps reinforcing emerging cultural trends, or even triggering long-term cultural transformations. For example, early pottery adoption may have created positive feedback loops by offering improved ways to process, store or serve specific resources in new kinds of containers, or in greatly increased quantities. This may have prompted further innovations in pottery design and usage at the same time that the new technology was itself transforming opportunities for local social interactions and wider cultural life. The playing out of these increasingly entangled histories could plausibly have unleashed powerful sociocultural dynamics that gave rise to new cultural possibilities.

Beyond the basic time–space patterns in the arrival of pottery into the Northern World, most of these vital questions about how and why pottery was integrated in northern lifeways, and the cumulative impacts of its adoption, all remain poorly understood. This lack of knowledge also creates a timely and exciting opportunity for archaeologists to muster current data, and to mobilize theory, new methods and comparative insights from ethnographic and experimental studies in order to better understand these intriguing adoption and innovation dynamics. In so doing, it should be possible to explore some of the decision-making processes and illuminate complex cultural and environmental influences that lay behind them. The goal of this

book is to address this gap; it undertakes the first in-depth comparative and contextual investigation of perhaps the most intriguing dimension of all hunter-gatherer pottery use: its dispersal into the Circumpolar North.

1.2 WIDER RESEARCH CONTEXT AND CENTRAL QUESTIONS

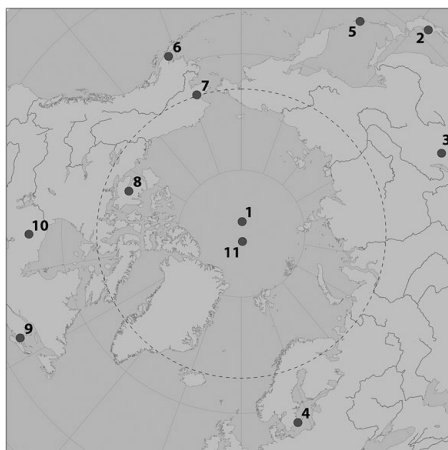
In the last ten years the role of prehistoric hunter-gatherers in the emergence and wider uptake of pottery has seen a fundamental reappraisal (Anderson, Tushingham and Buonas 2017; Frink and Harry 2008; Gibbs et al. 2017; Hommel 2014; Jordan and Zvelebil 2009; Jordan et al. 2016). As part of this revisionist history, foragers in China, Japan and the Russian Far East are now accepted as the innovators of the earliest pottery, which emerged in East Asia around 20,000 years ago. After the onset of the Holocene, hunter-gatherers living in a long arc that stretched from Arctic Norway and the Baltic through to Chukotka in Northeast Siberia, had all acquired and were maintaining vibrant pottery-making traditions. After 3000 BP, knowledge of the tradition was spilling over the Bering Strait into Alaska (see Chapter 6; Anderson et al. 2017).

Clearly, pottery was not brought into the Circumpolar North by the first human colonists; they had arrived much earlier, and so pottery must have spread via some kind of dispersal and adoption process. However, the extent to which this represented a single giant dispersal wave that originated first in East Asia and spread across Siberia and into northern Europe, or more complex patterns of localized invention and adoption remains unclear, and needs a comprehensive dating program to resolve (Jordan et al. 2016). Either way, in the rest of northern North America, a slightly different pattern played out: beyond Alaska, pottery was invented independently far to the south, and was then accepted into northern hunter-gatherer cultures during the Woodland Period (see Boyd et al.; Deal et al., this volume). Despite the diversity of these dispersal processes, the global adoption of pottery into higher latitudes generates several central questions:

- *What motivated the northern adoption of pottery traditions?*
- *What was the pottery used for?*
- *How was production and use of pottery integrated into seasonal routines?*
- *Why was pottery chosen over other rival cooking containers?*
- *What longer-term impacts were associated with the adoption of pottery?*
- *How did pottery traditions change over time?*

1.3 STRUCTURE OF THE BOOK

The book is organized so that chapters map onto the general history of pottery adoption into the Northern World (Figure 1.1): (a) the first set of chapters are



1.1. Location map of chapters forming this book: (1) research context: understanding the dispersal of pottery traditions into the Circumpolar North (Jordan and Gibbs); (2) early hunter-gatherer pottery in Japan (Uchiyama); (3) early pottery in Eastern Siberia (Vetrov and Hommel); (4) prehistoric pottery traditions, collective identities and cuisine among maritime foragers (Isaksson et al.); (5) use of pottery by maritime foragers in the remote Kurils Islands (Gjesfjeld); (6) understanding the function of container technologies in Southwest Alaska (Admiraal and Knecht); (7) archaeological and ethnographic perspectives on the use-life of pottery in Northwest Alaska (Anderson); (8) comparative analysis of pottery and soapstone cookware technologies in the North American Arctic (Frink and Harry); (9) investigating the function of prehistoric forager pottery in the Maritime Provinces (Deal et al.); (10) prestige foods and the adoption of pottery by subarctic foragers (Boyd et al.); (11) conclusions and research outlook: explaining the use of pottery among Circumpolar hunter-gatherers (Hayden).

set in northern Eurasia, and include Late Pleistocene and Early Holocene sites with very early traditions (Japan, Siberia); this section also includes case studies of later pottery assemblages dating to the mid-Holocene (Baltic; Kuril Islands); (b) the next set of chapters examines the later pottery traditions that had crossed over into the New World; these case studies are set in Alaska, the Aleutian Islands and in the Central Canadian Arctic; (c) two further chapters are set in Maritime and Sub-Arctic Boreal Canada and examine pottery traditions that likely had more southerly influences and (d) the final chapter undertakes a critical review of progress on northern hunter-gatherer pottery and highlights key themes for future research.

1.4 EMERGING INSIGHTS INTO NORTHERN CERAMIC TRADITIONS

Given that the oldest pottery was found in Japan and other adjacent regions of East Asia during the Upper Palaeolithic, the chapter by Junzo Uchiyama marks a useful point of departure for the rest of the book's case studies. It is important to develop this kind of baseline understanding of how this very early pottery was being used, and how it evolved and changed over time, before we start to explore how it was being employed at later dates in areas located further to the north.

The key question addressed by Uchiyama is what were the socio-economic contexts in which this very early pottery was innovated in Japan during the very cold conditions at the end of the Pleistocene? Uchiyama focuses primarily on the waterlogged Torihama site, and uses exceptional faunal and other important contextual data to explore the long-term trajectories of pottery use across the Pleistocene–Holocene transition, which was defined by major climatic and cultural transformations. In the very coldest phases of the Late Pleistocene, the first very limited numbers of small pottery vessels (small bowls that could be held in one hand) were just starting to appear at the site, which probably functioned as some kind of seasonal camp

for residually mobile foragers. Later, the site saw a major take off in pottery use during the Early Holocene, which has traditionally been linked to the shift away from hunting large game at the Pleistocene–Holocene transition, and towards the development of intensive fishing activities in the warmer conditions of the Holocene.

Importantly, Uchiyama is able to identify that diverse aquatic resources were *already* being exploited at the site in the cold conditions of the Late Pleistocene. The earliest pottery vessels were likely used to process some of these aquatic resources – probably hot and oily fish soups – which were consumed only during specialized ritual activities. In contrast, he argues that the wider Early Holocene “take-off” in pottery probably represented a qualitative shift from pots being used on these rare and highly ritualized occasions, towards becoming general purpose cooking and serving vessels (the later types are larger in volume and much more varied in style). Interestingly – and despite this shift – the close cultural association between pottery and the processing of aquatic resources endures for many subsequent millennia (see Craig et al. 2013, Lucquin et al. 2016).

V. M. Vetrov and P. N. Hommel also focus on early pottery assemblages in their chapter, this time on the Ust’ Karenga complex of sites in Eastern Siberia, which date to the Late Pleistocene. They highlight the need for in-depth studies of key sites and assemblages and through detailed archaeometric analysis of the earliest pottery assemblage found at the site, they are able to suggest that it was being used by highly mobile foraging groups, who exhibited few signs of social complexity; moreover, these groups probably carried the precious ceramic vessels with them as they moved between established camping sites located in different places in the landscape. These early pots have thin walls and were probably used for direct heating of contents over open fires. These insights tend to contradict the common assumptions that only complex hunter-gatherers (exhibiting a degree of sedentism) would start to develop or adopt pottery, and that pots would have been made and cached at seasonal agglomeration sites. Interestingly, there appears to have been no experimental stage at the sites, and adoption of pottery seems to have taken place as an already developed craft, and was then able to fit easily within this nomadic lifestyle. Certainly, there are no indications of wider transformations taking place at the point of its uptake; in fact, there is deep continuity in the lithic traditions both before and well after its arrival. Likewise, after the pottery tradition is adopted it seems to undergo no further innovation; it remains remarkably similar for many generations. In testing many basic assumptions about early northern pottery, these results are important, and signal that much more work needs to be done at early sites and ceramic sequences to map out the full diversity in its adoption and integration into preexisting lifeways.

The next chapter by Sven Isaksson, Kevin Gibbs and Peter Jordan shifts the focus to the opposite end of the continent and to later periods, by which time

a larger horizon of hunter-gatherer pottery use is now spanning northern Eurasia (Jordan et al. 2016). The enigmatic Pitted Ware Culture (PWC) is a hunter-gatherer pottery tradition that is concentrated in the coastal areas of eastern central Sweden, and may form the westernmost extension of a wider dispersal/adoption phenomenon. For example, it has little technological affinity with Funnel Beaker (TRB) pottery, which is also in use in the area, and was brought from the south with the spread of Neolithic farming communities. Focusing primarily on the period between 3600–3300 cal BC, this chapter paints a vivid portrait of highly mobile communities of “sea nomads” who moved constantly between a network of fixed landing sites. Here they produced and deposited the distinctive PWC pots, often in massive quantities. Archaeologically, these landing sites tend to be dominated by fish and seal bones, and frequently include human burials and other ritual objects. Large-scale organic residue analysis of the pottery across diverse sites indicates that the striking differences in PWC and Funnel Beaker or TRB pottery technology is mirrored, at least in the early PWC phases, with an equally distinct function: PWC is used to process aquatic resources, mainly sea mammals (probably seal), whereas TRB has other uses, including preparation of dairy products. Moreover, isotopic analysis of human remains recovered from both PWC and TRB sites indicates a similarly sharp differentiation into reliance on a marine versus terrestrial diet. These hunter-gatherer versus early farmer communities also exhibit sharp genetic/ancestral differences and origins.

The authors argue that this PWC pottery phenomenon reflects the emergence and maintenance of a very separate hunter-gatherer identity: these PWC communities lived as highly mobile coastal foragers; their distinct pottery style and function reflects deeper food cultures and culinary traditions that focused on exploitation of sea mammals. The capacity to maintain and communicate a distinctive identity in this way played an important role in these complex, multicultural forager–farmer interaction zones.

The next chapter by Erik Gjesfeld maintains the focus on maritime foragers, but jumps back across to insular Northeast Asia, to examine the paradox of pottery use in the remote Kuril Islands of the North Pacific. Here, between 3,700 and 500 years ago, local foragers maintained an enduring pottery-making tradition despite substantial environmental constraints, including limited clay resources, lack of firewood and damp and foggy weather, even in the summers. Interestingly, Gjesfeld is able to study the design and role of pottery over time, and argues that the local technology undergoes a major shift between the Epi-Jomon and later Okhotsk Culture: in the former, pots walls are thinner and mineral tempered, potentially indicating direct heating and general cooking; in the latter, vessels are flat-based, thick-walled and were probably used in combination with stone boiling to render precious marine fats and oils. These may indicate a general shift from routine cooking of local aquatic resources for local subsistence, towards a much more specialized production of marine

mammal fats and oils, which may have been used by the Okhotsk Culture as a valuable trade resource, enabling them to participate in wider regional exchange networks that spanned Northeast Asia (see also, Fitzhugh et al. 2016 for a wider discussion). This case study is important because it highlights the enormous “potentiality” of the pottery craft, and that the designs, roles and functions of northern ceramics were not fixed or predetermined but could, through local innovation, change dramatically over time.

The next set of chapters takes us over to the North American side of the North Pacific, where we start to see how acceptance of pottery “competed for space” alongside other food preparation technologies, such as stone bowls and griddle stones. Marjolein Admiraal and Rick Knecht develop this intriguing theme by tracing the divergent evolution of early container technologies in the Aleutian Islands and across various regions of Southwest Alaska. For example, in the Aleutians, use of stone bowls gives way to use of griddle stones but pottery is never adopted; sequences in mainland Southwest Alaska and the Alaska Peninsula undergo a major shift in technology and style between the Norton Palaeoeskimo (Palaeo-Inuit) Culture and the Thule Neoeskimo (Neo-Inuit) period, while Kodiak Island sees a much later adoption of pottery.

Whatever the exact technology deployed, each must have required choices about whether to invest skills and labor. A better understanding of vessel function may provide the key to unlock these localized developments; the authors highlight that little is known about the exact function of the different vessels, and that more analysis of organic residues will be needed to expand insights generated by earlier pilot studies (see e.g., Farrell et al. 2014; Solazzo and Erhardt 2007). However, the widespread use of marine fats, oils and blood in vessel construction and as a way of sealing fired pots prior to use may make interpretation of the organic residues difficult as preserved residues may reflect production methods rather than later usage.

More generally, the general pattern they identify across this vast area is that these diverse container technologies emerge primarily in coastal areas, and coincide in time with an apparent intensification of the marine hunting economy; this also seems to correlate with increases in seasonal or permanent sedentism, following many popular assumptions about pottery being compatible with settled forager communities undertaking mass harvesting of seasonal resources. However, there are also many intriguing spatiotemporal gaps in the distribution of pottery traditions that need more research to properly document and explain. Clearly, there is much research still to be done here.

The chapter by Shelby Anderson remains in Alaska, but moves further to the north, and examines pottery traditions in Northwest Alaska. She adopts a slightly different approach to understand the emergence of pottery traditions. She argues that here – as in many other areas of the North – the general time/space patterns of pottery traditions are already known in general outline, and in

many cases, this is where scholarship has been parked in recent decades. She argues that trying to explain and understand the deeper role of these traditions requires a means to deliver contextual insights into how it was embedded into the routines of daily life, from production, and through use and exchange.

To make progress on these important themes, she deploys a “use life perspective” to understand how sourcing, production, use and discard were integrated into other seasonal activities and combines archaeological and ethnographic data. Her results overthrow many common assumptions about northern pottery, for example, that clay sources are widespread, and that potters would always use the nearest sources. In fact, she uncovers substantial exchange of the raw clays between sites and regions, and also discovers that finished pots were being moved widely as well (see also, Vetrov and Hommel).

More generally, she follows other chapters in identifying a close association between pottery and marine resources but, again, uses of fats and blood in production may make it difficult to interpret results of residue analysis and resolve discussions about function. This is a pity as the technological and functional roles of many of these vessels are still rather unclear. More widely, her approach uncovers variability in roles and uses, and shows that making and using pottery in the North was always a difficult craft involving both high levels of investment, but also the persistent substantial contribution of culturally informed choices along the way.

Liam Frink and Karen Harry move the focus further to the east – to the Central Canadian Arctic. Crucially, they bring debates back to the choices and strategies that lay behind the adoption of rival container technologies (see also, Admiraal and Knecht), and seek to resolve the enduring puzzle of why pottery prevails in the western part of this zone, and soapstone bowls in the east, with some areas of geographic overlap in the middle. This pattern developed despite the common underlying economic reliance on sea mammals, fish and some land mammals for basic subsistence.

This chapter systematically tracks how a matrix of factors – ranging from environmental variability, seasonality and clay and fuel availability – can subtly influence the costs and benefits of each rival technology for communities inhabiting different parts of this large region. They also explore how pottery and soapstone compare in terms of engineering principles and performance characteristics. This approach uncovers three key insights: (a) pottery was favored in the West because there was more driftwood, people were more settled and less soapstone sources were available – here, clay cooking pots had an array of advantages; (b) in the East, communities were more mobile, less fuel was available and soapstone quarries were located close by – this alternative solution fitted better with these needs and constraints, giving this technological system strong advantages; (c) even more intriguing are the areas where

both technologies co-occur – this may represent seasonal use of the different technologies – pots are better in the settled summer camps whereas soapstone is better for the mobile winter-round, though these working conclusions need further research. In sum, this study highlights how a surprisingly complex set of choices and variables are at play, and that researchers need to look well beyond distribution maps and static culture historical tables, and engage with the full set of social and environmental factors to fully explain how and why pottery and other technologies were adopted, combined and abandoned. It is also important to understand the intersections between circumpolar diet, health and technology – the nutritional benefits of sea mammal meat is not enhanced by cooking; in fact, it is better if consumed raw or slightly cooked after brief immersion in hot water, perhaps using smaller vessels for par boiling.

The next two chapters remain in Canada, but move further to the south and east, and drop down into the sub-Arctic zone, first to the Maritime Provinces and then back west to the sub-Arctic zone of Central Canada. The results reported by Michael Deal et al. highlight the importance of recent innovations in pottery residue analysis. Pottery from north-eastern North America partly fits an emerging trend seen in other times and places (see Uchiyama): first, low numbers of small vessels in early phases of the Early Woodland, with preparation of fish oils for ritual feasting at large aggregation sites (reported by Taché and Craig 2015), followed by a trend towards larger pots and production in larger numbers in the Middle and Late Woodland. However, in contrast to the pattern in Japan, where a close association between pottery and aquatic products remains in place, by the Middle and Late Woodland, we see regional variation and in some areas, a transition towards cooking of food mixtures.

The case study in the chapter by Mathew Boyd et al. adds an entirely new perspective onto the dispersal of pottery among sub-Arctic foragers. Once again, the early adoption phases of pottery is associated with a narrow set of special resources. However, this chapter is set in forager/farmer contact zones, and rather than the processing of aquatic foods and valuable fish oils, we see use of the earliest containers for preparing domestic maize. This would have been an exceptionally rare food resource, either cultivated in small plots locally but more likely traded in. Either way, it was consumed at special places, probably regional aggregation sites, and may be tied to intergroup feasting via the consumption of socially significant meals, facilitating ways of interacting, including wider shifts in inter-group reciprocity during the Woodland period. These insights highlight the importance of understanding social contexts in the study of early pottery and add yet another twist to the story of how pottery dispersed into northern forager societies.

The [final chapter](#) by Brian Hayden provides a useful reflection on these emerging patterns, and he returns to the central focus of the book: if pottery production was so difficult in the Circumpolar North, there must have been

powerful motivations for the adoption of pottery. What were they? This is particularly relevant when we remember that people lived, and even thrived in the north for long periods *before* pottery appears in the archaeological record. His review makes several vital points: the coherent study of northern hunter-gatherer pottery traditions as a kind of general cultural phenomenon is only just at beginning phase; it is a relatively young research field, and much more work will be needed before a fuller picture emerges and can be properly explained. He also emphasizes the daunting spatiotemporal scope of this topic: it extends from some 15,000 years ago when pottery first started to emerge in Late Pleistocene East Asia, through to final dispersals up into the Boreal and Arctic zones of North America, which took place only around 3,000 years ago. All this means that the pursuit of single causes, common processes or universal patterns will be enormously challenging, but will be worth the effort invested, given the centrality of container technologies to northern lifeways and local cultural dynamics. One further source of complexity is that northern pottery could – and frequently did – evolve into new forms and functions; this means we will also need to address what drove cumulative innovation in the function and significance of pottery within, as well as between, different geographic areas.

1.5 DISCUSSION: THE EMERGING PICTURE

The main goal of this book is to undertake the first in-depth comparative and contextual investigation into the adoption of ceramics in the Circumpolar North. As the chapters illustrate, the emerging insights present no simple linear history; the history of northern pottery is as rich and diverse as it is complex and variable. However, two important trends run through the diversity and variability covered in the case studies. The first and perhaps the most central, is the close relationship between pottery and the processing of aquatic resources. In cold northern landscapes, these resources must have represented both a valuable but also storable high-energy commodity; acquiring it may have been the single most plausible motivation for the wider uptake of pottery across the Circumpolar North (Hayden). This makes it possible to raise the general working model that pottery spread into the North as part of a growing reorientation towards exploitation of aquatic resources, particularly for the extraction of desirable lipids. In turn, this trend appears to be associated with a more general trajectory leading towards increasing seasonal sedentism and growing social complexity, albeit with exceptions (Vetrov and Hommel). Rich soups or oils refined from aquatic resources would have had high social value in northern cultures due to their caloric contributions, important role in digesting proteins, and via their potential use in hosting rituals, feasting events and exchange networks (Hayden). Variability in this general trend may have arisen in areas where geology, environments or mobility patterns made use of clay simply impossible; here

alternative technologies like soapstone flourished to facilitate processing and use of aquatic resources, albeit in similar social niches (Frink and Harry). Further exceptions may arise in areas where hunter-gatherers were adopting pottery but opted instead to use it for processing exotic plants like maize, which also had a similarly high social value (Boyd et al.).

The second important trend is that during the early phases of pottery use we see limited use of a small number of rather small vessels, and in some cases this pattern persists over millennia; again, these vessels seem to be used for special foods like rich soups and oils, or at least in special social circumstances (Uchiyama, Boyd et al.). In later periods, there is a much wider uptake and dramatic shifts in forms, including production of apparently cruder versions. The latter may be linked to a shift in function towards what may be the more routine rendering of blubber into oil, perhaps for long-distance trade (Gjesfjeld).

1.6 DIRECTIONS FOR FUTURE RESEARCH

The uptake of pottery technologies across the Circumpolar North was part of an important cultural and historical process. The case studies presented in this book demonstrate that knowledge of this technology brought new opportunities but also significant challenges. In many regions, the wider time-space patterns pertaining to its general uptake are becoming clearer, at least in general outline. More of the complex contextual factors that guided its local uptake are also coming into sharper focus, and the potential contribution of pottery technology to longer-term developmental trajectories is becoming more apparent. However, much new work remains to be done to properly understand common patterns as well as what generates variability. Here we attempt to identify some of the most important themes for future research:

- Much more work is needed in Northern Eurasia. We need to know where and especially when pottery first started to spread up into sub-Arctic and Arctic Russia, especially in the large area stretching between the Urals, across Siberia and up into the North Pacific. This requires a large program of radiocarbon dating to understand specific adoption and dispersal routes, and how these related to large geographic features like major river systems or periods of climate change, and also how different ceramic traditions related to one another. However, directly dating the food crusts on this pottery will not be easy; there is a significant chance that vessels were used to process aquatic resources, and this may add Freshwater or Marine Reservoir Effects that need to be carefully controlled for.
- With higher-resolution chronologies in place, we need many more highly contextualized site-based studies to understand *how* pottery arrived into local cultural contexts, and to explore how its adoption related to potential changes in other aspects of behavior, be that technology, mobility, subsistence or social

organization (see Uchiyama; Vetrov and Hommel); lipid residue analysis to identify vessel function forms a natural extension to such work. However, evidence that blood, fats or oils from aquatic species may also have been used in the production stage, adds a further level of complexity that needs to be resolved (Anderson; Admiraal and Knecht).

- More work could be done to understand the use and life history of pottery used not only at habitation sites but also in funerary and other more ritualized contexts; to what extent did Arctic pottery (or other containers) have ceremonial status and use value (Hayden)?
- Additional research is needed to understand how pottery functioned as a “total social technology” (Frink and Harry), including the trade-offs and decisions that were being made in its production, use and discard. Many chapters already make use of ethnographic information, but deeper insights may start to emerge through a more systematic comparative analysis of data contained in northern ethnographies (including the extensive literature on Siberia); some of this work could also start to investigate the advantages and potentials of pottery alongside rival container technologies like bark, wood, stone and skin bags (Hayden; and see Frink and Harry for soapstone). Where this ethnographic information is not sufficiently detailed, targeted experimental work could then be conducted to identify comparative heating efficiencies, plus nutritional studies of cooked versus partially cooked or parboiled meat (Hayden).
- Again, the key question is *why pottery* (and not continued use or further refinement of some other existing container technology)? Once perfected, the pottery craft could easily be adapted, but what drove these dynamics; how and why were local pottery traditions transformed into subsequent roles? In later periods, historical and ethnographic sources may have valuable information about the loss of pottery traditions in favor of using metal trade vessels; this may shed light on what factors contribute to adoption, innovation and abandonment cycles within northern forging cultures.

1.7 CONCLUSIONS

This book undertakes a state-of-the-art review of an emerging research field; it presents a compelling yet in many ways still a preliminary exploration of the unique, specialized and at times surprising role played by pottery technologies in northern hunter-gatherer prehistory. While the chapters succeed in highlighting the impressive creativity and resourcefulness of higher-latitude foraging cultures, they also highlight many gaps in knowledge and understanding about the precise social role of ceramics technologies, and how pottery use contributed to longer-term change; these gaps present scope for launching a new generation of research projects.

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TWO

WHY DID NORTHERN FORAGERS MAKE POTTERY?

*Investigating the Role of Incipient Jomon Ceramics within
Wider Hunter-Gatherer Subsistence Strategies
in Prehistoric Japan*

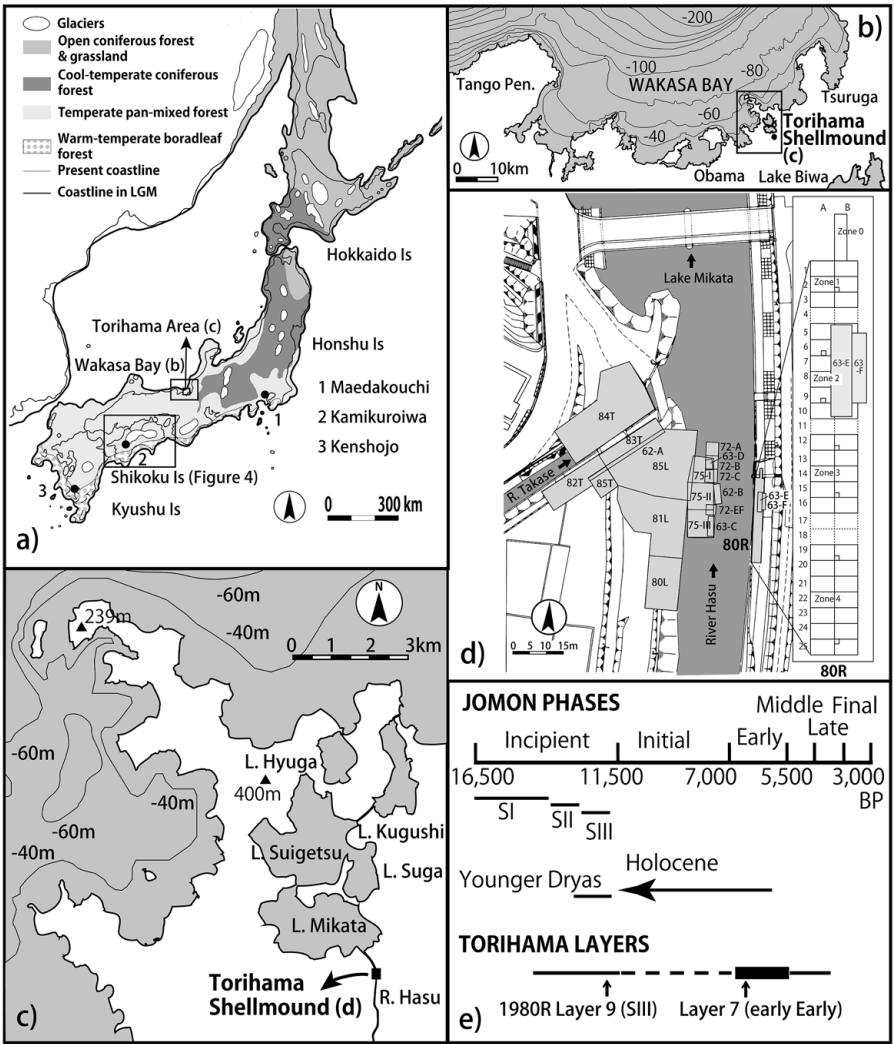
Junzo Uchiyama

INTRODUCTION

Hunter-gatherers in Northeast Asia were the world's earliest cultures to use ceramic technology, and the Incipient Jomon phase (ca. 16,500–11,500 cal BP) in the Japanese archipelago is a representative example. With more than 12,000 Late Pleistocene sites dated in and after the Last Glacial Maximum (LGM) in existence (Koroku 2014), the Incipient Jomon can be a key to answering the long-standing question: What motivated the Late Pleistocene northern foragers to make pottery, and how did they use it?

Many aspects of the socio-economic cultural conditions of Incipient Jomon society are not yet well known. This is largely because most sites are small in size and the amount of remains and features is limited compared to the later Jomon phases, which are dated to the Early Holocene. The actual conditions of subsistence strategy in particular remain unclear, due to the overall scarcity and poor preservation of organic materials. Small samples of animal bones have occasionally been discovered in limestone cave sites. However, these are mainly distributed in the inland mountains of the western part of Honshu Island and Shikoku Island (e.g., Kawamura 1991; Anezaki et al. 2009; Hasegawa et al. 2011). Sea level transgression beginning with the onset of the Early Holocene means that settlements near the shorelines, if any, must have been submerged. This makes it difficult to know how Jomon society adapted to aquatic environments.

The Torihama site (Figure 2.1, ca. 14,000–3000 cal BP) on the Japan Sea coast in Central Honshu, is one of the few coastal sites that can provide information on the conditions of early pottery use. Although its main layers belong to the Early Jomon phase (ca. 7000–5500 cal BP), a considerable amount of animal bones from the Incipient layers were found during the excavations of the early 1980s. The samples were preserved quite well in the water logged conditions. The steep topography around the site suggests that the coast was close enough for fishing activities even during the Late



2.1. Maps (a–d) of the location of Torihama and the chronological sequence of the layers of Torihama (e). Map (a) shows the vegetation zones during the LGM (based on Iwase, et al. 2012: figure 2), with the location of the sites mentioned. Map (d) is the plan of the Torihama excavations carried out from the 1960s to the 1980s. (based on Torihama Shellmound Research Group 1987: figure 2)

Pleistocene. Consequently, the site provides an interesting contrast to the inland cave sites that have traditionally been used to study Incipient Jomon subsistence. Moreover, Torihama has a sequence of layers following the Incipient phase, and therefore provides a rare opportunity to observe subsistence strategy in the period of early pottery innovation and how it changed from the Late Pleistocene to the Early Holocene.

Thus, the aim of this chapter is to contextualize the development of early pottery among northern hunter-gatherers in a wider sociocultural setting by examining subsistence strategy in the Incipient Jomon phase, and its changes in later periods on the basis of the analysis of faunal assemblages in Torihama.

ENVIRONMENT AND STRATIGRAPHY OF TORIHAMA

The Torihama site is situated on a river mouth flowing into Lake Mikata, about 6 km to the south of the Japan Sea coast in Wakasa Town, Fukui Prefecture of Central Honshu Island (Figure 2.1). Lake Mikata is a freshwater lake, the southernmost member of a group of five small fault lakes, named *Mikata Goko* (Mikata Five Lakes) (Figure 2.1c). Today, the northernmost part of the Five Lakes (Lake Kugushi and Lake Hiruga), has narrow connections to the sea, providing brackish water to the other four lakes. The Five Lakes were created by a subsidence of faults some 500,000 years ago. Since then, they have become freshwater lakes and the sedimentation process has gone on despite frequent earthquakes. The northernmost Kugushi Lake became an estuary in the period of the sea transgression in the Early Holocene (Kato 1990). Diatom and paleogeological studies suggest that freshwater has dominated environments surrounding Torihama since the Late Pleistocene (Okada 1984; Kato 1990; Yasuda et al. 2004). On the other hand, Torihama also enjoyed good access to the sea, even during periods of sea level change in the Late Pleistocene. Today geologists have a general agreement that the sea level was approximately 100 m lower than the present in the LGM (ca. 25,000 cal BP to 16,000 cal BP in Japan). After the LGM the Late Pleistocene saw a rapid rise of sea level; it reached ca. 30–40 m lower in the beginning of the Holocene (e.g., Lambeck 2014). This indicates that the distance between Torihama and the coast was as much as 25 km in the LGM but probably became well within 10 km at the close of the Pleistocene (Figure 2.1b and c).

Palaeobotanists have reached a general agreement that the Japanese archipelago was covered with forests during the Late Pleistocene (e.g., Yasuda et al. 2004; Iwase et al. 2012). Pollen analysis has found that temperate mixed forests of broad-leaved and coniferous trees were the basic vegetation in the Torihama area in the LGM, while the present day sees warm-temperate evergreen broadleaf forests (Miyamoto 1998; Yasuda et al. 2004). Such a combination of freshwater, maritime and inland mixed forests within walking distance would have allowed easy access to a range of food resources.

The Torihama site was found 3 m below the land surface, and the oxygen-poor, waterlogged conditions preserved organic remains extremely well. Discovered in 1962, the large-scale excavations from 1975 to 1985 were the first full-scale attempt of joint research between archaeology and natural sciences in Japan that focused on the analysis of organic materials and paleoenvironments. Layers containing a large amount of faunal remains were found together with artifacts made of organic materials such as lacquered wooden ware, wooden bows, stone axe shafts, strings and fabric fragments. Most of these layers were formed during the Early Jomon phase (Figure 2.1d and e, ca. 7,000–5,500 cal BP). Zooarchaeological research of the Early Jomon layers has so far established that a wide range of species was collected from the surrounding environments. The main land taxon represented is sika deer (*Cervus nippon*) and wild boar (*Sus scrofa*). Aquatic resources are dominated by freshwater mussels (Family Unionidae) and clams (Family Corbiculidae) as well as freshwater carp family fish (especially crucian carp, *Carassius* sp.). Even so, a notable amount of maritime fish such as tuna (*Thunnini* sp.) and red seabream (*Pagrus major*) are represented in the Early Jomon faunal assemblage (Nishida 1980; Hongo 1989; Uchiyama 2006). In contrast to the abundant faunal remains from the Early Jomon layers, deposits dating to the Incipient (ca. 14,000–11,500 cal BP) and the Initial Jomon (ca. 11,500–7000 cal BP) phases, as well as those following the Early Jomon (the Middle, the Late and the Final phases, ca. 5500–3000 cal BP), produced comparatively low numbers of animal bones. With regard to the Incipient faunal remains, however, it is still one of the largest samples in Japan of this period and can therefore provide valuable information on subsistence during the Late Pleistocene, and offers a rare opportunity to examine the extent to which Incipient Jomon society was adapted to aquatic resources. Until the present case study, no systematic analysis had been conducted for the Incipient Jomon animal bones. Consequently, the subsistence activities corresponding to the period of early ceramics are not well known.

MATERIALS AND METHODS

Incipient Jomon layers were found in the excavations in 1980, 1981, 1983, 1984 and 1985 (Figure 2.1d, Torihama Shellmound Research Group 1981, 1983, 1984, 1985 and 1987). As most of them are waterlogged, gravel-based layers bearing lots of organic materials in good condition, Torihama has played an important role in the dating and chronological arrangement of Incipient Jomon pottery types. Recent analysis has revealed that there are three major types of Incipient pottery at Torihama; in chronological order: SI (pottery characterized by *Ryukisenmon* type, i.e., raised linear design and also pottery preceding *Ryukisenmon* type), SII (represented by *Tsumegatamon*, crescent pattern applied by making a fingernail-like impressions design) and SIII

(*Tajomon*, cord-mark impressions design). These date back to approximately 16,500–13,000 cal BP for SI, 13,700–12,800 cal BP for SII and 12,500–11,500 cal BP for SIII (Taniguchi 2005; Sato 2008; Hagitani 2008). The SII sub-phase corresponds to the Allerød interstadial, and the SIII sub-phase is roughly contemporary with the Younger Dryas stadial at the end of the Pleistocene (Figure 2.1e).

So far about ninety bone fragments have been reported from the Incipient layers at Torihama, but no identification and analysis has been carried out until now. At Torihama the Incipient animal assemblage was mainly found from layers corresponding to sub-phase SIII and none date to the SI sub-phase. Most of the excavated soil was not water sieved, although samples from the 1980 excavations are an exception. In the district called “1980R” (named after “the district of 1980 on the Right bank of River Hasu,” Figure 2.1d), all soil samples from the Incipient layers (layers 9 and 10, both of which belong to SIII) were water-sieved with a 5 mm mesh, and the residues were separated into categories such as animal bones, plant seeds and artifacts (Torihama Shellmound Research Group 1981).

While several studies have focused on the Early Jomon animal bones (e.g., Nishida 1980; Hongo 1989; Uchiyama 2006), the lack of wet sieving in most areas has made it difficult to gain a full picture of the exploited animal resources during this period. Fortunately, the Early Jomon soil samples from 1980R were water sieved in the same manner as the Incipient layers. Consequently, these samples are suitable for systematic comparison between the Incipient and the Early animal assemblages, and can be examined to study the transition in subsistence from the Late Pleistocene to the Early Holocene.

In this study, I analyze the faunal assemblage collected so far from the Incipient layers, and also the Early Jomon assemblage excavated in 1980 for comparison (Table 2.1). In the assessment of the Early Jomon subsistence, the organic layers containing the earliest type of pottery of this phase is selected (Figure 2.1d), i.e., Hajima-Kasou-2 type pottery (KSU-1014: ca. 6800–6700 cal BP) (Suzuki 2012), corresponding to layer 7 of section 12B (1 m by 1.5 m). It consists mainly of organic materials and all the soil was water sieved with a 5 mm mesh.

To quantify the identified animal remains, I utilize two indices: the Minimum Number of Individuals (MNI) and the Minimum Animal Units (MAU). MNI is the number of the most frequently identified body part of a certain species, derived from the Number of Identified Species (NISP). MNI represents the minimum number of animals that could account for the bones in an assemblage, which is commonly used to discover a general frequency between different animals. On the other hand, MAU is a modification of NISP that allows for anatomical differences between species, calculated by bringing all bones into line with long bone articulations (equal to two per animal). MAU makes quantitative

comparison between species within the same animal class possible in a more accurate manner and also is suitable for evaluating body part frequencies within the same species. However, it is not possible to use it for comparison when crossing over animal classes due to basic anatomical structure differences.

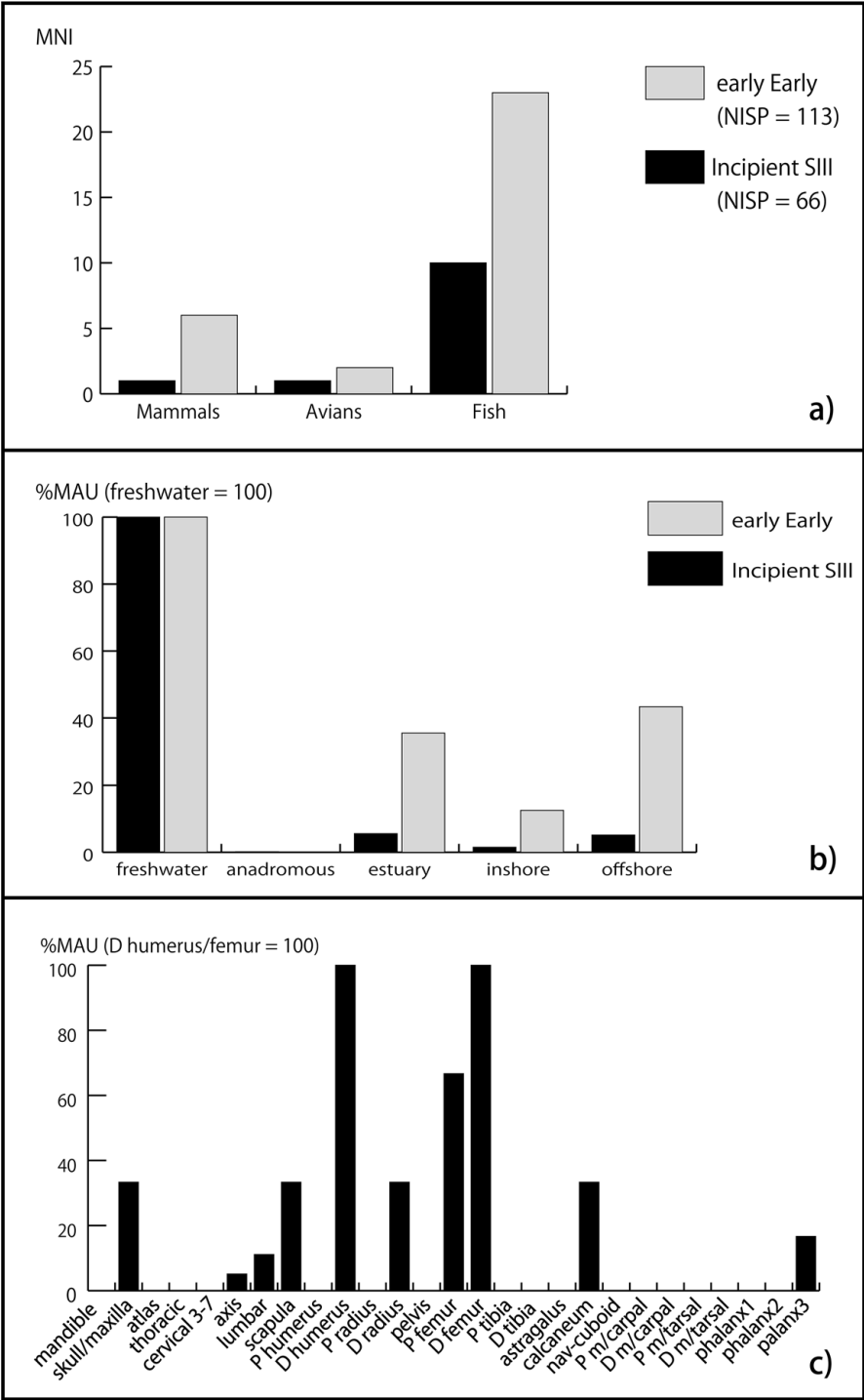
RESULTS

Incipient Jomon Phase

The total dry weight of all the Incipient bones is 0.5 kg and NISP is 86. There are no remains from sub-phase SI. Only five bones are from SII and all the others are from SIII. Out of eighty-one bones from SIII, sixty-six were retrieved from the 12A and 13A section of the 1980R water-sieved deposits (Figure 2.1d, Table 2.1). The overall condition of preservation was quite good, while the assemblage of SII looks slightly weathered in comparison. Identified species are listed in Table 2.1, consisting of six mammals, three birds and seven fish in the Incipient phase. With regard to mammals, the habitats of all five terrestrial mammals (sika deer, wild boar, Japanese serow, badger and wolf) cover mixed forests from the Sub-Boreal to temperate zones, reflecting the environments that existed around the site in the Late Pleistocene (Iwase et al. 2012, Figure 2.1a). On the other hand, a second metatarsal of sea lion (*Zelophus* sp.) that was identified from an SII layer, indicates that the coastal resources had already been used to some extent before the Younger Dryas. Fish bones have only been retrieved from the 1980R water-sieved SIII deposits.

The total bulk of the 1980R water-sieved SIII deposits is approximately 1.2 cubic m, which corresponds to fifty-five bones per 1 cubic meter of soil. There is only one bone for the mammal (sika deer) and bird (sandpiper) categories, while the other sixty-four are fish. Fish remains include two freshwater (crucian carp and cat fish), one anadromous (salmonid) and four maritime species. Apart from sixty to seventy salmonid teeth reported from SI layers at the Maedakouchi site in Tokyo (Tanaka 1985, see the location in Figure 2.1a), these are the first freshwater and maritime fish bones discovered from the Incipient Jomon. Maritime fish include species living in estuary (flathead grey mullet), inshore (blackhead sea bream and mackerel) and offshore (tuna/bonito) environments. Fish accounts for 80 percent of total MNI (Figure 2.2a). An MAU comparison (Figure 2.2b) of fish remains in different habitats shows that freshwater species were dominant, although species in environments extending from estuary to offshore are identified. This suggests that fishing was conducted in a range of aquatic environments during the late stage of the Incipient Jomon (sub-phase SIII) but focused on freshwater species.

There are few seasonal indicators from the Incipient samples. I identified a fragment of sika deer jaw tooth (M3) from the 1980R samples (Table 2.1). This



2.2. Histograms showing the animal assemblage at Torihama. a) is the MNI of different classes and b) is the %MAU comparison of fish species sorted by habitat and ecology, showing the results of wet-sieved samples of the Incipient SIII (Layer 9) and the early Early phase (Layer 7). The histogram (c) is the body part representation of sika deer from the early Early phase (Layer 7).

is an unworn tooth crown of the first or second cusp, which indicates that this deer was killed at thirteen to eighteen months old, judging from tooth eruption stage (Brown and Chapman 1991; Uchiyama 1998). Since sika deer normally give birth in early summer, this result suggests that hunting was carried out in summer and autumn in SIII. The fishing season for crucian carp and marine species must have been concentrated in summer when they come close to shore for spawning; during other seasons it is more difficult to catch these fish. With regard to the anadromous salmonid fish identified in the 1980R sample, autumn must have been the season to catch because this is when they come back to the rivers. Furthermore, shells of water chestnut (*Trapa japonica*), walnut (*Juglans* sp.), chestnut (*Castanea crenata*) and Japanese nutmeg (*Torreya nucifera*) were reported from Torihama SIII layers (Torihama Shellmound Research Group 1981 and 1984), which mature from September in this part of Japan today. There are also some indicators that hunting was carried out during the winter months. Wild geese and mallard are migratory birds (Torihama Shellmound Research Group *ibid.*) that spend the winter in the Japanese archipelago today, appearing from October to February from central to northern Honshu (Brazil 1990). Putting these results together, several indicators of seasonality during the SIII sub-phase suggest activity during summer and autumn, while some other activities such as bird hunting may have been carried out in winter.

Early Jomon Phase

The bulk of the Early phase soil sample (layer 7) is approximately 0.45 cubic m. The dry weight of the faunal assemblage is 0.9 kg and NISP is 113. Thus, the number of bones per 1 cubic meter soil is 251.1. The layer consists of mainly organic materials under waterlogged conditions in which all the animal assemblage has been preserved very well. As listed in Table 2.1, there are five mammals (sika deer, raccoon dog, monkey, wild boar and fox), two bird species (mallard and crane) and fourteen fish species identified. For mammals, sika deer is dominant (NISP: 16, MNI: 2). Fish bones account for 74.2 percent of the total MNI (Figure 2.2a). This suggests that fishing was a major activity, similar to the Incipient SIII sub-phase at Torihama. The MAU comparison between fish species in different habitats (Figure 2.2b) shows that, like in the Incipient period, freshwater fish were dominant, although Maritime fishes from various environments were also caught.

There are no indicators of seasonality for the Early Jomon mammals. Considering that the spawning season of fish is summer, fishing activity must have been carried out mainly in summer when fish come to shallow water on the shore. With regard to avian species, mallard and crane, both appear in the Japanese archipelago in midwinter. Among plant remains, acorns, walnuts and water

chestnuts were reported (Torihama Shellmound Research Group 1981). Acorns and walnuts are autumn indicators, and water chestnuts are harvested in summer. Consequently, there are traces of subsistence activities in all seasons except spring.

From a broader settlement or spatial perspective, what functions did Torihama have in the subsistence system in the early stage of the Early Jomon? Deer hunting was seemingly one of the major activities since deer comprises a large amount of NISP in mammals (16 out of 27). Body part representation analysis and comparison with ethnographic data may be useful (Uchiyama 2014). Although it is difficult to determine site function on the basis of only sixteen fragments of deer, the high proportion of femur (5 out of 16) is noteworthy (Figure 2.2c). Ethnographic records of hunting activities, for example caribou hunting among the Nunamiut in Alaska (Binford 1978), often point out that useful elements with more meat, fat and marrow like upper hindlimbs tend to be taken back to the residential base. A previous analysis of late Early Jomon fauna from the 1984 excavation at Torihama concluded that 1) deer and wild boar were major resources and 2) the site was a residential base during summer to autumn, which was the season of deer hunting and fishing, but 3) in winter the base camp was moved into the mountains and Torihama was visited only by hunters as a wild boar hunting camp (Uchiyama 2006). The assemblage analyzed in this study is too small to conclude anything definitive about site function. Further investigations would be needed to see if the spatial pattern observed for the late Early Jomon period also existed in earlier periods.

SUBSISTENCE STRATEGIES IN THE INCIPIENT AND THE EARLY JOMON

The results of the analysis so far suggest that there are more similarities than differences in the basic structure of subsistence of the late Incipient and the early Early Jomon phases at Torihama. Firstly, exploited terrestrial mammals consist of species from mixed forests from the Sub-Boreal to the temperate zones with deer being the major game animal. This may reflect the surrounding environments, which were estimated to have already been temperate mixed forests in the LGM (Miyamoto 1998; Yasuda et al. 2004; Iwase et al. 2012; see also, Figure 2.1a). Secondly, fishing was a major subsistence activity. Aquatic resources were widely exploited both in the Incipient (SIII sub-phase) and the Early Jomon periods; fish remains include species attributed to a range of environments from freshwater to open sea. A comparison of MNI (Figure 2.2a) indicates that the overall importance of fishing activities was not significantly different between the two periods. One sea lion metatarsal identified in the Incipient Jomon samples may suggest that the adaptation to the maritime environments could date as far back as to SII, which corresponds approximately to the Allerød interstadial. Thirdly, during both the Incipient (SIII) and Early Jomon, freshwater species comprise

the highest proportion of the fish remains (Figure 2.2b). This indicates that freshwater fishing was consistently the major activity in aquatic environments. Lastly, the seasonality considerations indicate that the site was occupied when fish became available, specifically from summer to autumn, although it should be noted that this assumption is based on only a few indicators of seasonality. It can be confidently stated that coastal lowland environments attracted human groups since long before the Holocene.

On the other hand, there are two major differences between the analyzed Incipient and Early Jomon assemblages. First of all, the volume density of faunal remains clearly grew from the Incipient to the Early Jomon. In the 1980R excavation, NISP volume density of the Incipient SIII layers is fifty-five, whereas in the layer of the early Early phase of section 12B it is 251.1, which is approximately 4.57 times greater. This indicates that Torihama was used much more intensively during the Early phase. The Incipient Jomon society was presumably still quite mobile and most probably based on nomadic foraging. Secondly, although freshwater fish remained the dominant aquatic resource, statistical comparison of the relative frequencies of aquatic species by MAU (Figure 2.2b) shows that maritime fish increased significantly in the Early phase (Kolmogorov-Smirnov test, $\chi^2_0 = 8.255$, $P = 0.032$). Therefore it can be said that fishing activity became more complex in the early stage of the Early Jomon as resources in various maritime environments were exploited more intensively, although Incipient Jomon foragers already had enough skills to catch sea fish including offshore species.

DISCUSSION: SOCIO-ECONOMIC FUNCTIONS OF EARLY POTTERY

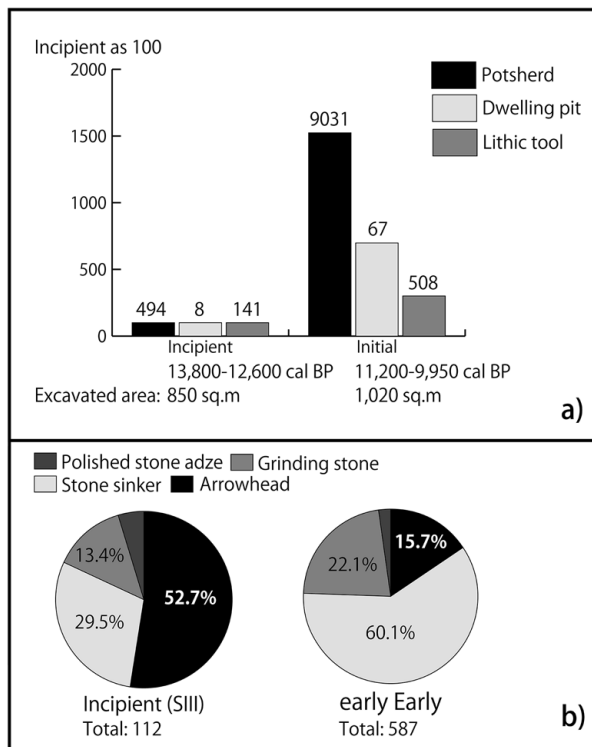
The comparative analysis of the Incipient Jomon faunal assemblage with the Early phase at Torihama has revealed that fishing, in particular freshwater fishing, was a major subsistence activity and that the exploitation of aquatic resources extended from freshwater to offshore environments in coastal lowlands of Central Honshu in the Incipient SIII sub-phase. It is unclear if fishing was also an important activity during the earlier phases of the Incipient Jomon due to the lack of wet-sieved samples. However, the remains of a sea mammal (sea lion) from SII suggested that resources from aquatic environments had already come into use by the SII sub-phase at Torihama. It is noticeable that a large amount of salmonid teeth and vertebrates have been identified from SI layers at the Maedakouchi site, which is located on a river terrace 20 km to the west of Tokyo and is the only other Incipient Jomon site where fish remains have been discovered (Kato 1985). This fact strongly suggests that inland fishing was an important activity during the earliest stage of the Incipient Jomon, dating back to before the Allerød interstadial. Freshwater fishing was also important in the Early

Holocene, although fish remains from the Early Jomon phase of Torihama suggest a greater relative increase in the exploitation of maritime environments. Freshwater fish MAU increase by 1.32 times from the Incipient (SIII) to the early stage of the Early Jomon (from 19.54 to 25.74) but maritime fish increase by 9.94 times (from 2.37 to 23.55) (Table 2.1, Figure 2.2b).

It seems likely that early ceramic containers could be connected to fishing activities. A recent analysis of Torihama pottery revealed that the majority of samples of charred residues left inside Incipient SII–SIII earthenware containers had markers of aquatic organisms, indicating that resources from both freshwater and maritime environments were cooked or processed in pottery (Craig et al. 2013). This result is consistent with the faunal remains. The results from Torihama raise new questions about the function of pottery in Incipient and later Jomon society: What role did early pottery play in a societal system in the Late Pleistocene? Are there any functional differences between pottery in the Incipient and later periods? To answer these questions, it is necessary to consider pottery in wider sociocultural contexts.

The amount of early pottery found at Late Pleistocene sites is much smaller than at Early Holocene sites in the Japanese archipelago. Except for a few exceptional sites in southern Kyushu Island, the number of potsherds per site is normally less than fifty at most Incipient Jomon sites. After the onset of the Holocene, however, the numbers increased dramatically, sometimes reaching over 30,000 sherds from a single site (Taniguchi 2004: 48–50), although it should be noted that other types of cultural remains also increased after the end of the Last Glacial, such as lithic tools, dwelling pits and faunal remains. Even so, it seems that the increased frequency of pottery was greater than these other materials.

For instance, at the Kenshojo site in Kagoshima in southern Kyushu Island (Figure 2.1a), both Incipient and Initial Jomon layers have been retrieved. The width of the excavated area was about 1,000 square meters, and both layers cover approximately 1,000 years in timescale. The Initial layers contained more dwelling pits, lithic tools and potsherds, indicating that the site became heavily used in the Initial phase (Aira Town Board of Education 2005). As shown in Figure 2.3a, when we calculate the proportion of increase in the Initial phase from the value of each component in the Incipient phase, we can see that pottery exhibits an outstanding level of growth. At Torihama, lithic tools (projectiles, arrowheads, stone sinkers, scrapers, saddlequerns, grinding stones, axes, etc.) increased 5.64-fold from the late Incipient (SIII) to the early Early phases (Torihama Shellmound Research Group 1985: 44–45) (Figure 2.3b), while the density of faunal remains increased 4.57 times. It appears that the increase in lithics and fauna was approximately equal, reflecting that Torihama became more heavily used in the Early Holocene. While there is no quantitative data about the amount of pottery at Torihama, it appears that the increased rate of pottery was much higher.



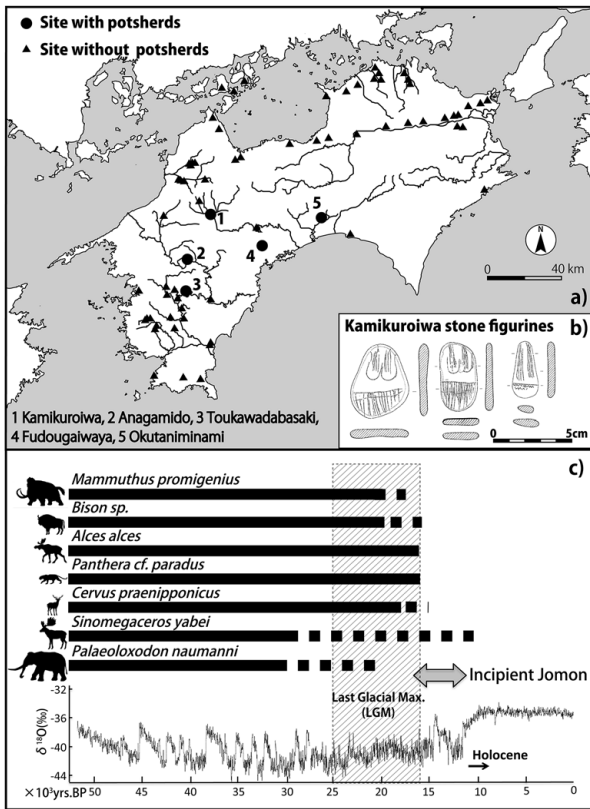
2.3. Comparison of the amount of potsherds, dwelling pits and lithic tools between the Incipient and the Initial phases at Kenshojo (a) and comparison of lithic assemblages (polished stone adzes, grinding stones, stone sinkers and arrowheads) between the Incipient SIII and the early Early phases at Torihama (b).

It is also noteworthy that in the Early Holocene we see not only a growth in abundance of pottery but also in vessel size and variability. Incipient Jomon pottery consists primarily of deep bowls that are small enough to carry in the hand; they are often only as big as a large jug of beer (1–5 liters). In later periods larger pots became more common and some other shapes, such as shallow bowls and constricted neck pots, appeared. It has been pointed out that from the Initial Jomon onwards, pottery can be differentiated into two categories: fine wares and coarse wares (e.g., Iguchi 1994). Fine pots are quite limited in number and highly decorated, suggesting that they were for special purposes like ceremonies, whereas coarse ones are more common and rather plain in design, indicating that they were for daily use in cooking and serving food. This phenomenon probably reflects the fact that social organization became increasingly complex (e.g., Watanabe 1990). In general, it can be said that beginning in the Holocene, pottery became a more common utensil to use in different situations in everyday life.

In contrast, the overall scarcity, small size and simple shape of early pottery indicates that Late Pleistocene ceramic containers were likely not used for everyday tasks, despite their relatively widespread appearance at Incipient

Jomon sites across the Japanese archipelago. A recent analysis of Torihama pottery from the Initial and the Early phases revealed that it was also used mainly for processing aquatic resources. This shows that pottery usage remained largely unchanged since the Incipient phase in spite of the probable increase in terrestrial resource diversity associated with environmental amelioration in the early Holocene (Lucquin et al. 2016). The analysis of faunal assemblage suggests that no fundamental shift in subsistence occurred from the Incipient to the Early phases, indicating that changes in pottery technology and function were caused more by changes in sociocultural conditions, rather than changes in subsistence strategies.

Furthermore, pottery is not found at all Incipient sites. For instance, out of 120 Incipient sites discovered so far in Shikoku Island, only five have potsherds (Figure 2.4a) (Harunari et al. 2009). This does not happen in later periods, in



2.4. Map a) shows the Incipient Jomon sites distributed in Shikoku Island (modified from Hyodo 2009: figure 7), and (b) shows examples of stone figurines (pebbles with carved line drawings) from Kamikuroiwa, which were associated with Incipient potsherds (Harunari 2009: figure 205 and 206). Part (c) indicates the timing of megafaunal extinction in Japan (Iwase et al. 2012: figure 4) with the reconstructed fluctuations of temperature based on the isotopic analysis of Greenland ice cores. (Stuvier and Grootes 2000)

which all sites generally have large amounts of pottery. It is noteworthy that most Incipient Jomon sites with pottery are located in the “key locus” of a region, such as higher vantage points like hilltops, distinguishing rock shelters and caves, and transportation crossroads like at the junction of rivers. Ritual paraphernalia, such as incised pebbles and earthen figurines, tend to also occur at such places. Such locations appear to have been significant in some way and repeatedly visited. Thus, the major role of Incipient Jomon pottery may have been related to ritual activities to strengthen social bonds. It is most probable that as a rare and valuable commodity, Incipient pots were meant for more limited usage on special occasions such as to produce prestige materials like fish grease for ceremonies, as Brian Hayden has suggested (Hayden 1995). If this assumption is true, it is quite natural that the size of Incipient pottery is generally small, because people did not need large vessels to extract rare materials, and for people who were still largely based on nomadic foraging, it was necessary to carry pots frequently when settlements moved.

CONCLUSION

Debate over Incipient Jomon subsistence has so far centered on lithic tool composition due to a lack of organic remains. Such studies have often considered that subsistence strategies fundamentally shifted from a heavy dependence on terrestrial mammals, as represented by hunting tools like arrowheads, to a more aquatic resource-oriented strategy during the Pleistocene-Holocene transition, when fishing tools such as net sinkers first appear. While the stone tools from Torihama follow this general pattern (Figure 2.3b), the analysis of faunal remains from the site indicates that fishing was a major activity since at least the late stage of the Late Pleistocene in coastal areas. This result may prompt a rethink of how people caught fish in the Incipient phase, given that stone sinkers only appear in later periods. Other kinds of tools, such as fish traps or fishhooks could be alternatives.

Although food residue analysis indicates that ceramic containers were used to process aquatic resources, the comparative consideration about the role of pottery from a sociocultural perspective suggests that pottery was primarily used on special occasions for ritual purposes during the Late Pleistocene, while from the Early Holocene onwards, it came into common use for daily cooking. If this theory is accepted, what factors motivated northern foragers to develop and accept ceramic vessels? Why did people need a new type of ritual in which ceramic vessels played an important role, and why did people give a special meaning to the processing of aquatic resources?

Recent calibrated radiocarbon dates have provided convincing evidence that the first pottery can be traced back to long before the Younger Dryas stadial, well into the Older Dryas stadial in the Japanese archipelago. Charred

residue samples of potsherds from the Ôdai-Yamamoto I site in Aomori Prefecture, in the northernmost part of Honshu, are dated to between 16,850 and 16,240 cal BP (NUTA-6510) (Nakamura et al. 2001). This date coincides with the LGM. There were two major terrestrial mammal groups in the Late Pleistocene in Northeast Asia, the *Palaeoloxodon*-*Sinomegaceroides* complex, which was represented by Naumann's elephant (*Palaeoloxodon naumanni*) and giant deer (*Sinomegaceros yabei*), and adapted to temperate forests, and the mammoth fauna in the colder northern taiga and grassland. Recent evaluation of mammal fossils revealed that major species of the former group became extinct around the onset of the LGM, and the latter disappeared slightly later, when the climate started to ameliorate (Iwase et al. 2012) (Figure 2.4c). Such a contraction of large mammals must have forced northern foragers to face the overall decrease of terrestrial animal resources. This is just speculation, but such a situation may have resulted in putting fishing activity in the spotlight to supplement the declining productivity of hunting.

It has been pointed out that animal hair is often blended in the clay paste of early Incipient (SI) pots but this never happened in later periods (e.g., Shiraishi 2008; Sato 2008). This may suggest an association between early pottery and animal skin during the earliest phases of pottery production. Pottery filled with hot fish soup could have played a ceremonial “substitute” for hunted game, perhaps representing fertility and associated with prayers for resource productivity during a period of declining Pleistocene fauna. If this suggestion is on target, it is quite natural that northern hunter-gatherers developed ceramic container technology for ritual purposes in the coldest period of the Last Glacial. This chapter aimed to understand the subsistence background and to consider the sociocultural roles of early pottery among northern foragers by using the Jomon as an example. Much more analysis and research is needed in order to take these ideas forward, and the preservation of Jomon sites and remains is of paramount importance.

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APPENDIX

TABLE 2.1. *Animal assemblage from Torihama. The three tables show the samples of the Incipient layers (a) and the wet-sieved samples of layer 7 (early phase) (b).*a) *Incipient Jomon samples (SII-SIII)***SII (Non-wet-sieved sample)**

Latin	English	NISP	MNI	MAU	Body part	Habitat/ ecology
<i>Mammalia</i>						
<i>Cervus nippon</i>	Sika deer	4	1	4	Calcaneous R, rib (2nd) R, radius dis L, femur prox R	Terrestrial
<i>Zalophus</i> sp.	Sea lion	1	1	0.4	2nd metatarsal R	Rocky shore
Total		5	2			

SIII (Wet-sieved sample with a 5 mm mesh, from layer 9, 1980R)

Latin	English	NISP	MNI	MAU	Body part	Habitat/ ecology
<i>Mammalia</i>						
<i>Cervus nippon</i>	Sika deer*	1	1	1	M3 R (jaw tooth)	terrestrial
<i>Aves</i>						
<i>Scolopacidae</i> sp.	Sandpiper	1	1	1	Femur R	wader
<i>Osteichthyes</i>						
<i>Cyprinidae</i> sp.	Cyprinidae	50	3	12.31	Abdominal & caudal vertebra	freshwater
<i>Carassius</i> sp.	Carassius	3	1	5	opercle R, 2nd & 4th v.	freshwater
<i>Silurus asotus</i>	Common catfish	4	1	2.13	Abdominal v., 2nd– 5th v.	freshwater
<i>Salmonidae</i> sp.	Salmonid	1	1	0.03	Abdominal/caudal v.	anadromous
<i>Acanthopagrus schlegelii</i>	Blackhead seabream	1	1	1	Hyomandibular R	estuary
<i>Mugil cephalus</i>	Flathead grey mullet	1	1	0.08	Abdominal/caudal v.	estuary
<i>Scomber</i> sp.	Mackerel	3	1	0.29	Abdominal & caudal v.	inshore
<i>Thunnini/Sardini</i> sp.	Tuna/bonito	1	1	1	preural v.	offshore
Total		66	12			

* The unworn loose jaw tooth M3 (1st/2nd cusp) indicates the deer was hunted 13–18 months after birth, from July to December (Based on the tooth eruption progress shown in Uchiyama 1998).

SIII (Non-wet-sieved sample)

Latin	English	NISP	MNI	MAU	Body part	Habitat/ ecology
Mammalia						
<i>Cervus nippon</i>	sika deer	5	1	4.4	skull (frontale), antler, 3rd thoracic, rad dis R, fem prox L	terrestrial
<i>Capricornis crispus</i>	Japanese serow	2	1	2	rad dis R, tibia dis R	terrestrial
<i>Meles meles</i>	badger	2	1	2	pelvis L, fem prox R	terrestrial
<i>Sus scrofa</i>	wild boar	1	1	1	scapula dis R	terrestrial
<i>Canis lupus</i>	wolf	1	1	1	calcaneus R	terrestrial
Aves						
<i>Anserinae</i> sp.	wild goose	3	1	3	humerus L, cor L, ulna R	wetland/ migratory
<i>Anas platyrhynchos</i>	mallard	1	1	1	coracoid R	wetland/ migratory
Total		15	7			

b) Early Jomon samples (early part of Early Jomon)

Layer 7 (Wet-sieved sample with a 5 mm mesh, 1980R)

Latin	English	NISP	MNI	MAU	Body part	Habitat/ ecology
Mammalia						
<i>Cervus nippon</i>	sika deer	16	2	12.99	humerus dis L, femur dis R	terrestrial
<i>Nyctereutes procyonoides</i>	raccoon dog	6	1	4.4	maxilla R, mand L, ulna prox & dis R, 2nd metatarsal prox & dis R	terrestrial
<i>Macaca fuscata</i>	monkey	2	1	1	max R, max L canine tooth	terrestrial
<i>Sus scrofa</i>	wild boar	2	1	2	hum prox R, patella L	terrestrial
<i>Vulpes vulpes</i>	fox	1	1	1	scapula dis L	terrestrial
Aves						
<i>Anas platyrhynchos</i>	mallard	2	1	2	carpo-mc L & R	wetland/ migratory
<i>Gruidae</i> sp.	crane	1	1	1	radius R	wetland/ migratory
Chondrichthyes						
<i>Elasmobranchii</i> sp.	Elasmobranchii	1	1	—	vertebra	—
Osteichthyes						
<i>Carassius</i> sp.	Carassius	24	6	20.57	opercle R	freshwater
<i>Silurus asotus</i>	common catfish	7	2	5.17	dentary L	freshwater

(continued)

TABLE 2.1. (*continued*)

Latin	English	NISP	MNI	MAU	Body part	Habitat/ ecology
<i>Takifugu rubripes</i>	Tiger puffer	7	4	7	Premaxilla R	Estuary
<i>Lateolabrax japonicus</i>	Sea bass	4	1	1.38	Preopercle R, abdominal & caudal v.	Estuary
<i>Mugil cephalus</i>	Flathead grey mullet	3	1	0.46	Abdominal & caudal v.	Estuary
<i>Acanthopagrus schlegelii</i>	Blackhead seabream	3	1	0.33	Caudal v.	Estuary
<i>Scomber</i> sp.	Mackerel	3	1	2.18	Dentary R, preop L, caudal v.	Inshore
<i>Pagrus major</i>	Red seabream	1	1	1	Premax R	Inshore
<i>Scomberomorus</i> sp.	Spanish mackerel	1	1	0.04	Caudal v.	Inshore
<i>Thunnus</i> sp.	Thunnus	17	1	6.42	Ceratohyal R, max R, articular R, quad R, premax R, abdominal & caudal v.	Offshore
<i>Seriola</i> sp.	amberjack	9	1	4.23	Maxilla R, articular L, abdominal & caudal v.	Offshore
<i>Katsuwonus pelamis</i>	bonito	2	1	0.38	Abdominal & caudal v.	Offshore
<i>Trachurus japonicus</i>	Japanese horse mackerel	1	1	0.13	Caudal v.	Offshore
Total		113	31			

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THREE

VESSELS ON THE VITIM

“Neolithic” Ceramics in Eastern Siberia

V. M. Vetrov and P. N. Hommel

INTRODUCTION

The site complex of Ust'-Karenga has been a focus of heated debate within the Russian archaeological community since the excavation of a sealed cultural layer containing pottery sherds in association with a characteristically Upper Paleolithic stone tool assemblage in the mid-1970s. Over the last decade and a half, these ongoing discussions have begun to draw attention from a global archaeological audience (Gronenborn 2008; Jordan and Gibbs 2013; Jordan and Zvelebil 2009; Kuzmin and Orlova 2000; MacKenzie 2009; van Berg and Cauwe 1998). Thus far, however, publications on this site and its materials, particularly its pottery, have remained brief or linguistically inaccessible to the majority of researchers. Outside Russia, what information has been published has often been buried in papers focused primarily on dating, or nestled within generalized models for the emergence and spread of pottery technology; currently, no detailed, accurate and up-to-date description of this material exists.

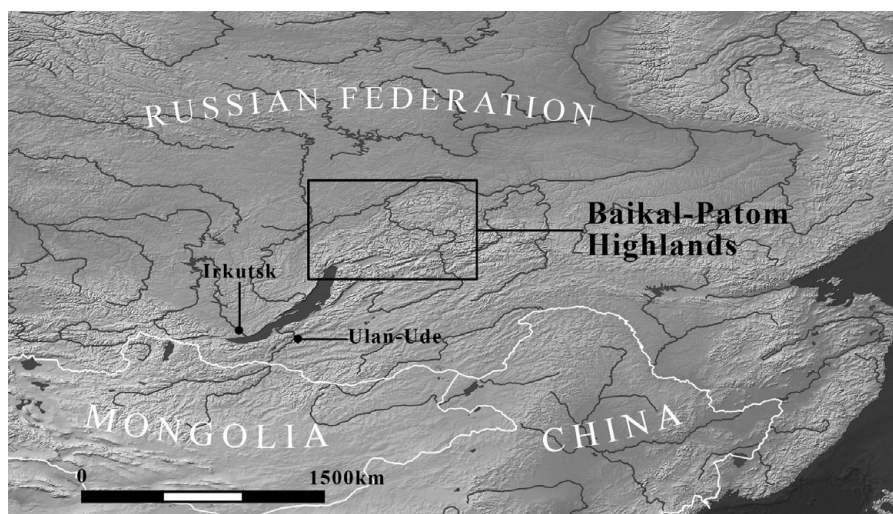
The aim of this chapter, therefore, is to address this significant gap and provide a more holistic presentation of the so-called Neolithic pottery assemblages of the Upper Vitim Basin. However, moving beyond “traditional” descriptive archaeological presentations of the material, the chapter will also incorporate the results of recent analytical research at Ust'-Karenga (see also, Hommel in press; Hommel et al. 2016, 2017a, 2017b) and present our current interpretations of this material in broader social, economic and regional

perspectives. These conclusions force us to question a number of widely held ideas about pottery, including its assumed relationship with the process of sedentarisation and its utility as a marker of broader social change.

Although it would be a mistake to overlook the value of generalization and model building in early ceramic research, given the limited material available to study, we seek to emphasize the importance of considering the character and context of the material on its own terms. To ignore this is to undervalue the complexity and variety of human relationships with pottery and to succumb to the lure of any single explanation of origin.

GEOGRAPHICAL CONTEXT

The site complex of *Ust'-Karenga* (italicized here and henceforth to distinguish the site from the eponymous culture) is located in the Upper Vitim Basin in the Western Transbaikalian region of Eastern Siberia. It consists of a series of sites and findspots within the alluvial terraces around their confluence of the Karenga and Vitim Rivers, two kilometres downstream from the village from which the site takes its name. Its position at the northeastern edge of the Vitim Plateau places it within a wide landscape of domed or serrate ridges and terraced intermontane valleys bordered by the higher hills and mountains of the Yablonovij Range (to the south and east), the Ikat Range (to the west) and the Muya, Kalar and Olekma Ranges (to the north and northeast) (Bridges 1990; Flint 1947; Kuzmin and Vetrov 2007; Thiel 1957). These mountains form the watershed for the upper course of the Vitim River, whose swift rain-fed currents cut a course through the heart of the plateau before snaking northwards to its confluence with the Lena River at the modern town of Vitim (Figure 3.1).



3.1. Location of the Ust'-Karenga site.

The climate of the region is best described as harsh and ultra-continental. It is characterized by long, cold winters and short, warm summers, with average annual temperatures in the region falling well below zero (-5 to -12°C) (Alekseeva and Erbajeva 2000; Belyanina et al. 1999). Today its larch-pine taiga (boreal forest) and waterlogged meadowland provides a surprisingly rich environment for plant, animal and insect life – both aquatic and terrestrial.

From a geological perspective, the Vitim Plateau, which lies within the Mongolian-Transbaikalian fold belt at the eastern periphery of the active Baikal Rift, is also rich and varied (Johnson et al. 2005). The geology of the region is overwhelmingly dominated by granites and gneisses with discontinuous outcrops of diorites and gabbro. However, various local metamorphic processes and overlying formations (both volcanic and sedimentary) give many parts of the plateau a distinctive “micro-regional” character (Atlas Zabaikal’ya 1967; Golushkov et al. 1971; Kalininoj and Malykh 1958; Malyshev 1964; Pobedash and Pavlova 1972; Smelovskim et al. 1962).

As a result of its resources, both ecological and geological, the Vitim Plateau has long been a focus of human habitation. Today, however, the permanent human presence is minimal. Outside a few larger settlements, such as the town of Romanovka, the majority of its inhabitants live in small isolated villages or hamlets, subsisting on the results of hunting, small-scale agro-pastoralism and the gathering of wild foods. The primary economic activity is winter fur hunting, which the whole community is involved in, with squirrel and sable being the main quarry (Brandisauskas 2006). Reindeer herding, which was once an essential part of the lives of the indigenous Orochen-Evenki population, is now becoming increasingly rare (Anderson 2006).

In addition to its permanent residents, the region has long provided a seasonal or temporary home to scores of geologists, miners and mineral prospectors, who operate out of bases across the plateau. Many of the early archaeological discoveries in this region, including the site complex of *Ust’-Karenga* itself – identified by the geologist V. Kh. Shamsutdinov in the late 1960s – were made as a direct result of this geo-economic prospection (Aksenov et al. 2000, 9).

ARCHAEOLOGICAL RESEARCH HISTORY

Since the mid-1970s, small teams of researchers from the Irkutsk State University and the Irkutsk State Pedagogical University have extensively studied the patterns of prehistoric development in the region. However, the basic subdivision of its cultural history, defined in the early surveys, has retained its essential validity and is still in use today (Aksenov et al. 1975; Vetrov 2000). This developmental model identifies two distinct and successive cultural

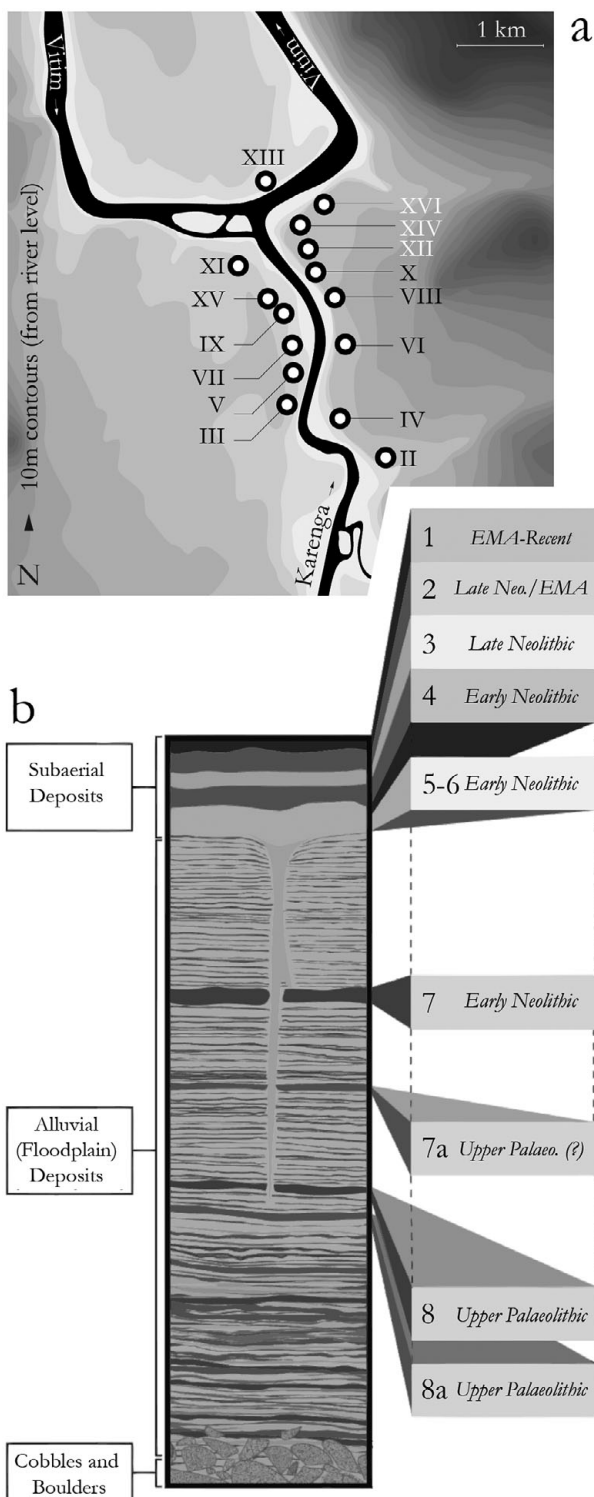
assemblages in the archaeological material, which together span the period from the Upper Paleolithic to the beginning of the Early Metal Age (Vetrov 1992, 2000). These long-lasting “archaeological cultures” – united on the basis of particular groupings of categories and types of archaeological materials (Vetrov 2000: 28) – have since been identified, separately or in sequence, at more than sixty sites across the Plateau. The cultures take their names, respectively, from the most extensively studied of these sites: *Ust'-Karenga* and *Ust'-Yumurchen* (Vetrov 1992; Vetrov and Kuzmin 2005).

Both of these cultures are often described as “Neolithic,” both here and more widely in the literature. However, this is simply because they include ceramic vessels in their material repertoire. Traditionally, in Russian archaeology, it is pottery rather than agriculture or animal husbandry that serves as the defining characteristic of the Neolithic Age (Jordan and Zvelebil 2009). There have been various discussions about the appropriateness of this classification over the years (e.g., Vetrov 2000), but we will not develop these further here. The important point is that all of the materials we discuss in this chapter were made and used within hunter-gatherer societies.

To date, the earliest finds in the region have come from the site complex of *Ust'-Karenga*, specifically from a small group of more or less contiguous sub-sites on the 20–25 m terrace on the right-hand side of the Karenga river, where it joins the Vitim (*Ust'-Karenga* XII, XIV and XVI) (Figure 3.2a). The least disturbed, most deeply stratified and most extensively excavated sub-site in this group is *Ust'-Karenga* XII (Ineshin 1979; Vetrov 1992; Kuzmin and Vetrov 2007). Its stratigraphy and geomorphology is considered representative and has been used as a basis for comparison with the stratigraphic situation both at other sites within the complex and in the wider Vitim region (Vetrov 1992) (Figure 3.2b).

Below the organic litter of the forest floor, ten distinct cultural horizons have been identified (Kuzmin and Vetrov 2007; Vetrov 1981, 1992). The lowest cultural horizons (8a, 8, 7a and 7) are set within well-sorted, thinly-stratified, rhythmically-deposited sands characteristic of floodplain alluvium across the basin. The cultural layers are typically thicker and darker in color, containing significant amounts of charcoal and cultural material more or less *in situ* (Ineshin 1979). The rhythmically-deposited alluvial sediments that separate these layers, appear to be archaeologically sterile. The upper cultural layers (6–1) correspond to Holocene diluvial and subaerial deposits and soils.

Layers 8a–4 are associated with the *Ust'-Karenga* Culture, while the subsequent layers are attributed to the *Ust'-Yumurchen* Culture. Material from both of these phases is found within layer 4, though this is usually attributed to root activity or other forms of disturbance. We will discuss these two phases separately and in detail shortly.



3.2. Map of the Ust'-Karenga complex and generalized stratigraphic section.

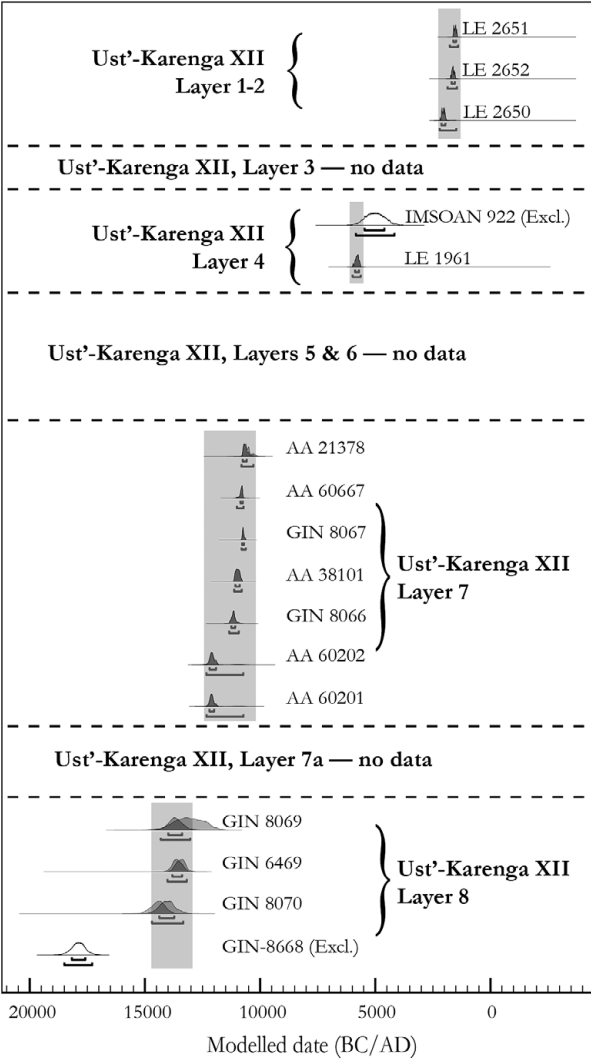
THE UST'-KARENGA CULTURE; DISTRIBUTION, MATERIAL CULTURE AND SITE STRUCTURE

Cultural Distribution

First described at the eponymous type site in the late 1970s, the Ust'-Karenga culture represents the earliest identified evidence of human occupation of the Upper Vitim Basin. Since its “discovery,” diagnostic traces of the Ust'-Karenga culture have been found at sixteen other site clusters across the Vitim Plateau, though excavation at these locations has, thus far, been quite limited (Vetrov 1992: 9).

Although rightly renowned for its precocious ceramic tradition, the first manifestations of the Ust'-Karenga cultural assemblage are aceramic (*Ust'-Karenga* XII layer 8a-7a) and the culture is essentially defined by its lithic assemblage. Pottery fragments associated with the Ust'-Karenga culture have been recovered from just four sites on the plateau: *Ust'-Karenga*, *Ust'-Yumurchen*, *Chernyaka II*, and *Ust'-Oktoekon* (Vetrov 1992). Because the last two sites in this list produced only single sherds (from layers of uncertain date) and because the fragments of Ust'-Karenga vessels from *Ust'-Yumurchen* are attributed to a later sub-phase, the argument for Late Pleistocene pottery in the Upper Vitim Basin has been built almost exclusively on the basis of material from the type site itself.

A series of radiocarbon measurements from layer 7, made on both charcoal and organics from within the pottery itself, was published around the turn of the twenty-first century, confirming original estimates, which placed the date of the layer in the Late Pleistocene. Unsurprisingly, these remarkably early dates have been contested hotly. Recently, opposition has crystalized around a proposed offset or “anomaly” in radiocarbon results from this period across the Transbaikal (e.g., Konstantinov 2009). However, this notion can now be rejected. A series of dates obtained by single aliquot Optically Stimulated Luminescence (OSL) has produced a sequence of broad dates, two of which, taken from the earliest ceramic layer, overlap in the region of the existing radiocarbon results (Hommel et al. 2017b). A further re-evaluation of the accumulated dating evidence from the site, using archaeologically-informed Bayesian modeling, allows us to confidently maintain this early date and place the early evidence of pottery use at the site firmly in the Late Pleistocene, between 12,200 and 10,500 cal BC (Figure 3.3). Though the lower chronological boundary of the culture could not be further constrained by the stratigraphy, we can estimate that the chronological span of the whole Ust'-Karenga cultural phase (layers 8a-4) lies between c. 14,200 and 5500 cal BC.



3.3. Summary of modeled radiocarbon dates for the dated cultural layers at Ust'-Karenga XII.

Lithics

The lithic industry of the Ust'-Karenga culture centered on the production of microblades from wedge-shaped, prismatic and sub-prismatic cores and appears to form part of a much broader technological group (Vetrov 1992, 1995, 2000; Vetrov and Kuzmin 2005, 2007). Characteristic core production techniques and the presence of diagnostic transversal burins of the “Verkholensk” or “Araya” type are typical of Upper Paleolithic assemblages across a wide swathe of northeastern Asia and beyond (Chard 1960, 1974; Ineshin 2006; Kuzmin

et al. 2007; Moroz 2008; Seong 1998; Slobodin 2001; Vetrov 2000: 29; Vetrov and Kuzmin 2005; Vetrov et al. 2006). In addition to these microblade cores and tools, equally characteristic flake and blade tools, arrowheads, scrapers and knives, as well as various forms of multipurpose biface were found, some of which were used as preforms for the production of microblade cores (Ineshin and Teten'kin 2010; Vetrov 1992, 2000; Vetrov and Kuzmin 2005).

Lithic trace-wear studies on similar materials from contemporary sites in the Transbaikal have suggested that the majority of these tools were probably connected with the processing of skins and the butchering of carcasses. However, various specialized functions, including wood, antler and bone working, were also identified (Ineshin and Teten'kin 2010; Moroz 2008). Although this level of scientific analysis has not yet been applied to the Ust'-Karenga material directly, the same general conclusions were reached by other means (e.g., Vetrov 1995b).

The lithic industry of the Ust'-Karenga culture should be seen as the product of a well-defined, stable tradition, displaying remarkable continuity in tool forms and production techniques across thousands of years. Changes can be observed in the composition of the assemblage over time, and in later phases we see the introduction of new artifact forms: so-called net-weights, bifacially-worked leaf-shaped blades, hatchets, sub-rhombic arrowheads and other types of projectile point, as well as more subtle shifts in the relative frequency of core types and microblade forms (Vetrov 1992, 1995b, 2000). For the most part, however, this variation is a matter of degree rather than kind. The first significant shift in stone tool technology, occurs alongside other changes in material culture which define the "emergence" of the Ust'-Yumurchen culture in the Middle Holocene.

Pottery

The Ust'-Karenga pottery tradition which appears, without discernable preamble, in cultural layer 7, is certainly the most remarkable feature of this cultural group. It has been described several times in recent years, both in English- and Russian-language publications. These descriptions are typically short, basic and surprisingly variable in content, whether as a result of cumulative abbreviation, translation by non-specialists or both. The most complete descriptions have been presented only in earlier Russian language publications and in unpublished dissertational works (Ineshin 1979; Vetrov 1992). These texts are not widely available even within Russia. The following description summarizes the information given in these earlier sources in the light of more recent research.

The total ceramic assemblage from across the Vitim Basin that can be associated with the Ust'-Karenga culture has tended to be underestimated in previous descriptions (e.g., Kuzmin and Vetrov 2007). However, this is probably because many compositionally distinctive vessels were represented by just a few

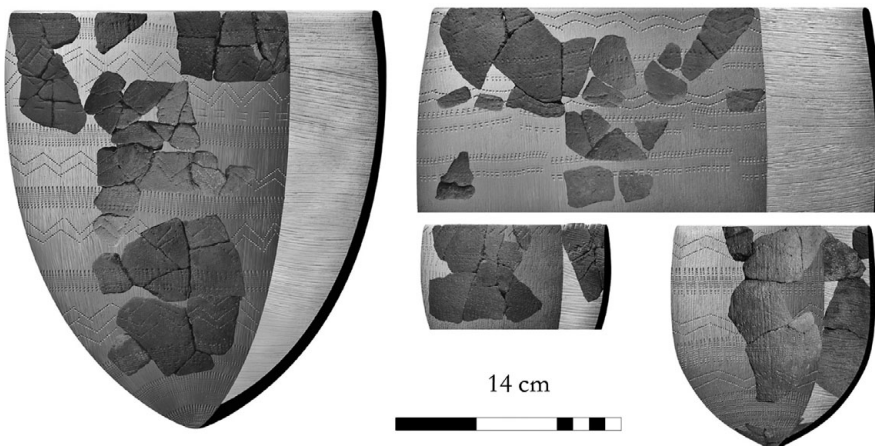
scattered sherds. From a total assemblage of around 1,750 small fragments (mostly $>1.5 \text{ cm}^2$), sixty-one probable vessels were identified in our re-analysis. These 'vessels' were defined through a combination of a macroscopic examination of ceramic fabrics and a detailed study of technical style. A more conservative minimum number would place this figure closer to fifty vessels. The vast majority of this material was recovered at the site complex of *Ust'-Karenga*, and more than half (32–35 vessels) came from the Late Pleistocene layer 7 itself.

Although heavily fragmented, eight of these early vessels were reconstructed sufficiently to allow a general formal type to be established. All the vessels within the assemblage appeared to conform to this type and can be concisely described as simple, closed parabolic or truncated-ovaloid forms, with pointed (acuminate) bases and slightly rounded, incurving rims (Vetrov 1985a). In other papers they have also been more subjectively described as "mitre-shaped" and "mammiiformed" (e.g., Kuzmin and Vetrov 2007; MacKenzie 2009).

Though of a single form (Figure 3.4), the vessels can be subdivided into:

- Small vessels – Rim diameter between 12–16 cm (13.5 cm average) and an estimated height of 16–18 cm.
- Large vessels – rim diameter between 20–30 cm (29.5 cm average) and an estimated height of 30–35 cm.

Vessels of both sizes are thin-walled, typically around 4–5 mm. Their consistency in form allowed rough estimates of vessel volume and weight to be attempted for the most complete vessels. The usable volume of the small vessels was estimated to be around 1 liter (cf. Ineshin 1979:12), and the approximate weight of the fired vessel would have been less than 0.5 kg. The average volume of the larger vessels was estimated at around 12 liters, and the vessel weight at about 2.5 kg.



3.4. Selection of Early Ust'-Karenga culture vessels from layer 7, Ust'-Karenga XII–XVI.

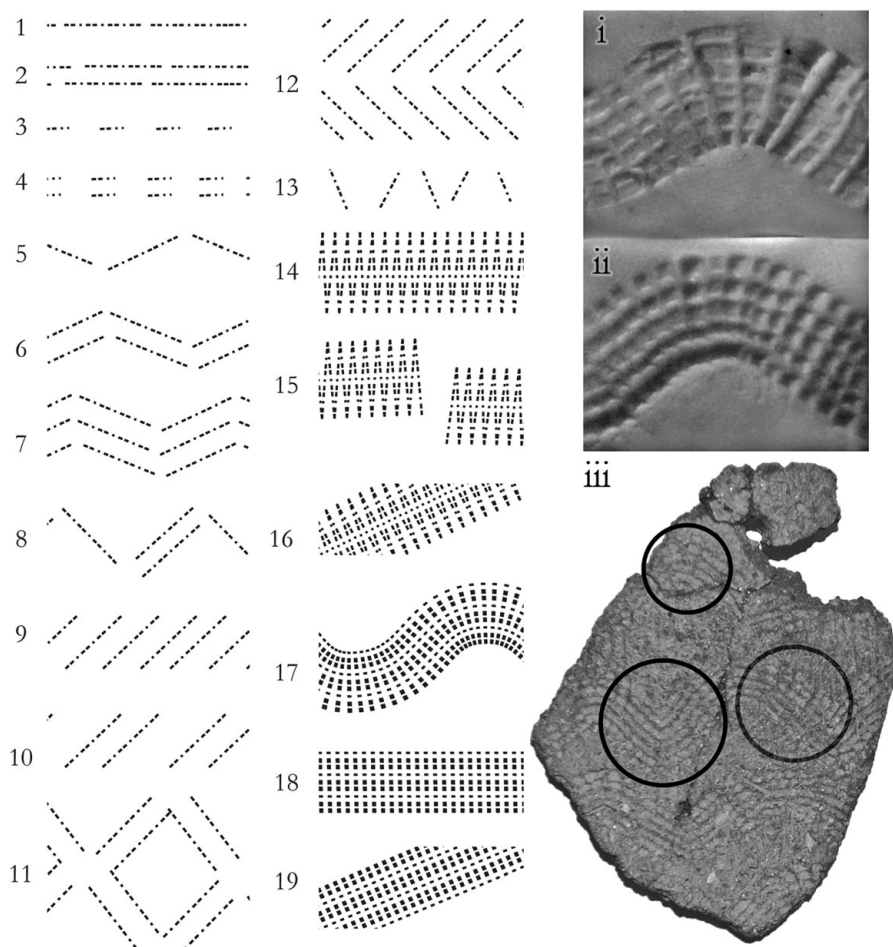
The techniques of primary forming, determined macroscopically, can be described as a combination of coil and strip/band-building and “*vykolachivaniya*” (lit. squeezing), which Anglophone writers usually translate as “paddle-drawing” (see MacKenzie 2009: 200). However, it more precisely describes the process of “technical” decoration, discussed shortly, which played a very important role not only in the consolidation and thinning of the vessel walls, but also in the refinement of the final form. Some of the coil-joins identified are n-form: “the lower bands convex and the upper bands concave” (Vetrov 1985a: 122). Others show construction as flattened bands with wide diagonal z-joins. The latter may explain an apparently two-layered structure identified in the wall of some sherds (see Vetrov 1985, *cf.* Shevkomud and Yanshina 2012). Some of the smaller vessels appear to have been produced primarily by simple pinching, and the rim area and lip of several larger vessels appeared to be constructed from a series of thin coils, much narrower than those of the lower body. Unfortunately, the small size of the assemblage (and its apparently wide chronological span) does not allow us to make much interpretation of this interesting variation. It is perhaps for this reason that the majority of the “technological” discussion in the literature has focused on surface treatment and “ornament.”

Although the form of the well-preserved Ust'-Karenga vessels is certainly distinctive, because of the fragmentary nature of the assemblage the decorative style is the clearest and most useful marker of this cultural type. The process of decoration is simple, and is often split into two separate stages of “technical” and “artistic” decoration.

The “technical décor,” as it is referred to in the literature, is perhaps better described as general surface modification associated with a strong tradition of secondary forming. The practice presents as roughly parallel striations running horizontally around the interior surfaces of the vessels and vertically across the exterior. This texturing of the vessel surface was clearly intentional and absolutely characteristic of the Ust-Karenga material and is seen on all but a handful of sherds from the earliest layer (albeit with varying degrees of clarity). In most cases, the striations were produced by wiping/scraping the vessel surfaces with a tight bundle of grass (Ineshin 1979; Vetrov 1985a). However, in several cases the regular spacing of the lines suggests the use of a toothed implement, and in one other case, similar marks appear to have been made by using a cord-wrapped stick. These latter examples require further consideration, but are not typical of the assemblage (*contra* Yanshina 2017).

A thin layer of fine clay on the surface of several of the analyzed vessels, which often appeared “slip-like” in macroscopic analysis (partly as a result of different oxidation states at the surface), was also attributed to the practice of “technical decoration.” However, it was ultimately identified as a self-slip, produced during wet-wiping/scraping of the vessel surface, rather than an intentionally added surface layer (*cf.* Hommel et al. 2008).

The "artistic" decoration seen on Ust'-Karenga pottery was produced almost entirely by comb-impression. With the exception of a few "undecorated" vessels, comb-impressed geometric designs – composed of straight lines and zigzags produced by a single impression or stepping-comb/rocker-stamping techniques (Figure 3.5, 1–19), were particularly characteristic of the ceramic tradition. This "artistic" decoration is usually arranged in parallel registers around the body of the vessels, though some diagonally oriented motifs have also been



3.5. Images 1–17 (left side): Motifs encountered on Ust'-Karenga culture ceramics: 1-Single continuous line; 2-Double continuous line; 3-Single interrupted line; 4-Double interrupted line; 5-Single impressed zig-zag; 6-Double impressed zig-zag; 7-Triple impressed zig-zag; 8-Asymmetric (double-single) zig-zag; 9-Even diagonal impressions; 10-Paired diagonal impressions; 11-Double impressed diamond; 12-Chevron; 13-Open single zig-zag (rim dec.); 14-Horizontal stepping-comb; 15-Interrupted/Cheque stepping-comb; 16-Diagonal stepping-comb; 17-Repeated-single stamp (Waveform); 18-Repeated-single stamp (Horizontal Linear); 19-Repeated-single stamp (Diagonal Linear). Images i-iii (right side): Experimental reconstruction of: i) Roller-stamp, ii) Close-spaced single impressions and iii) The original sherd from Ust'-Karenga XIV with areas showing clear similarities to (ii).

noted (Vetrov 1992). Decoration typically covers at least the upper third of the body, but often extends across the whole exterior surface, from lip to base. The interior surfaces very rarely show comb-impressed designs, though comb impressions across the lip are commonplace across the assemblage.

The number and fineness of the teeth of the combs used to make these marks varied considerably between vessels, but no significant pattern within this variation was identified (Vetrov 1985a). Where it was possible to study both the single and stepping-comb elements on a single vessel, it was clear that they were all made with the same comb.

Another technique, roller-stamping (using a cogged wheel or a toothed drum) was initially considered as a possible explanation for some long straight lines and wavy designs. However, subsequent analysis and experimental research has demonstrated that, in the latter case at least, the relevant impressions were created by close-spaced individual comb impressions, as a variant of the standard tradition of comb-stamping seen across the rest of the assemblage (Figure 3.5i-iii). The uniqueness of the particular motifs, however, remains extremely interesting.

Though earlier publications described the ceramic styles at *Ust'-Karenga* as autochthonous developments, with more distant connections dismissed as “convergent evolution,” the rapidly growing body of research into early East Asian pottery provides several reasons to revisit this conclusion. It is now clear that a number of approximately contemporary pottery assemblages in the Russian Far East (e.g., *Goncharka* and *Gromatukha*) and the southern Transbaikalian (e.g., *Studenoye* and *Ust'-Kyakhta*) show similar forms and/or production styles – particularly with regard to the distinctive practice of “technical decoration” (Razgildeeva et al. 2013; Shevkomud and Yanshina 2012). These close similarities are increasingly difficult to dismiss and, despite protestations to the contrary, it is very likely that these adjacent traditions are more or less directly related (Kuzmin 2014: 3). Further similarities in lithic technology and some vessel forms might suggest that the transmission of pottery occurred within an existing socio-technological substrate, which perhaps served as a “conveyor belt” (*sensu* Gronenborn 2011: 74) between the communities of the Amur and adjacent areas (see also, Kajiwarra and Kononenko 1999). The apparent break in the transmission of the technology into communities further to the north and west is a matter that urgently requires more attention (Hommel 2015).

Initial compositional studies, based on stereoscopic examination, described the ceramic body as a combination of clay, inorganic mineral inclusions and burnt-out organic material – “finely chopped grasses, hair, and granitic grus” (Ineshin 1979: 12). The latter component has also been referred to as “crushed” (Vetrov 1985a: 124) and interpreted as an intentional addition to the clay because it reflects “a conglomeration of grain compositions that is not encountered in nature” (Ineshin 1979, 12). Nevertheless, almost all recent publications,

particularly those in English, refer to the pottery as "primarily plant fibre tempered" (McKenzie 2009: 177) and clearly consider this to be a cultural practice and a "distinctive feature of the Ust'-Karenga [assemblage]" as a whole (Kuzmin and Vetrov 2007: 12). It is significant that organic inclusions were not discussed in such terms in any of the original publications of this material.

Further studies of the ceramic composition, based on the petrographic analysis of a near total sample of the Ust'-Karenga vessels from the site and clay samples taken from the surrounding region, lead us to question several of these assumptions. Firstly, the character of the organic inclusions within the ceramics is entirely inconsistent with the interpretation of "tempering." The quantity and range of organic material – typically an assortment of fine roots, wood/charcoal fragments, grass stems, insect wingcases and other, as yet unidentified, materials – was almost precisely similar to that seen in modern subsurface clay deposits (Hommel et al. 2017a). Similarly, though the description of "granitic grus" is broadly accurate, very little evidence was found to support the idea that this rock/mineral material was culturally modified (crushed) or intentionally added. Again, the composition of the ceramics paste was entirely consistent with the use of largely unmodified, natural clay from primary or (locally re-deposited) colluvial sources.

The mineralogical study also allowed us to add significant new information to our understanding of the Ust'-Karenga material. Although across the assemblage the granulometry of the samples was very homogenous, the mineralogical variation seen between individual vessels was very significant. Unsurprisingly, given the geological context, clay material formed from the weathering of various felsic granitoids was the most widely used resource, but the range of granitic lithologies represented was far greater than the immediate geological vicinity of the site could provide. This sense of variety was reinforced by the fact that a significant proportion of the assemblage was also made up of material derived from the weathering of more immediately distinctive rock types: igneous (mafic plutonic and volcanic), metamorphic and sedimentary in origin. In several cases, the nearest known outcrops of these materials were more than 30 km from the site.

Although some of the vessels were potentially consistent with local production, many clearly were not. This conclusion has very significant implications for our interpretation of this material. We could go further, if we consider that the rock formations around *Ust'-Karenga*, which are the basis of its geological character, are also widespread across the plateau and the fact that the inhabitants of the site apparently ignored the alluvial clay deposits, which predominate in the immediate vicinity of the site. We should not be too quick to assume that *any* of the ceramic material found at the site was necessarily made there.

Studies of firing temperature have confirmed expectations that the Ust'-Karenga pottery was open "bonfire" fired: typical firing temperatures (estimated

by various methods) were around 650–700°C. Post-firing alterations were common, particularly bored, conical perforations. These have been plausibly interpreted as evidence of vessel repair (Vetrov 1985a). The absence of adhesive (e.g., birch-bark tar) around the break, which is seen in later prehistoric vessel repairs, was interesting, but as no definite conclusions have been reached about its significance, it will not be considered further here. The predominance of rims and upper body fragments, compared with lower-body/bases could have its explanation in similarly conservative behaviors, such as the removal of damaged vessel rims (along a coil join) to allow the utility of the lower body to be preserved. Such practices are been noted in many ethnographic studies of traditional pottery use in mobile societies (Lindahl personal communication).

As was indicated for the lithic industry, there appears to have been considerable continuity and homogeneity in the ceramic traditions of the Ust'-Karenga culture. This is all the more remarkable given the potential flexibility of clay as a medium for creativity. Again, the first clearly identifiable cultural shift occurs between cultural layers 4 and 3 at *Ust'-Karenga XII*, with the “arrival” of the Ust'-Yumurchen culture (Vetrov 2000; 2013).

Clustered Remains

Whereas the upper layers of sites in this region are often disturbed, the early layers at *Ust'-Karenga*, buried deep beneath the surface, appear remarkably well preserved. On the basis of the stratigraphic position of the site and the nature of the associated sediments, the site was formed within the contemporary floodplain of the river(s) (Ineshin 1979). Evidence of soil formation and the fact that the majority of the materials appear to have remained more or less *in situ*, seems to suggest that destructive flooding events were relatively rare.

Within these early layers, the vast majority of the archaeological remains were found within well-defined sub-circular scatters between three and five meters in diameter (Ineshin 1979; Vetrov 1985a). These accumulations are usually focused around a number of discrete charcoal-rich zones, presumably hearths, and appear to be composed of a variety of domestic debris dominated by lithic debitage, microblades, cores and other tools, with occasional fragments of bone and teeth, degraded beyond physical identification. From layer 7 upwards, the pottery that enters the material record is also found within the same kind of accumulations (Ineshin 1979; Vetrov 1985a; 1992; 2000). These accumulations occur across the site, either singly or in small clusters, the area between them being largely sterile. They are interpreted as evidence of temporary settlement and are presumed to have been associated with light, surface dwellings (Vetrov 1985a).

While examining similar material scatters elsewhere in Siberia, other researchers have drawn the same conclusion, suggesting that these dwellings

were likely to have been conical structures like the *dhum*, *laavu* or *tipi* familiar from ethnographic description and popular culture (e.g., Kovaleva 1993). Across northern Eurasia, such dwelling structures are traditionally constructed from a number of long, angled poles covered in stitched bark or hide with an insulated floor of conifer branches covered with skins (Ineshin 2006; Konstantinov 2002; Mochanov 1969). In some cases, as at the site of *Bol'shoy Yakor' I* (located at a confluence on the lower course of the Vitim), similar scatters, also focused around "groups" of hearths, have been studied intensively (Ineshin and Teten'kin 2010). The conclusion of this work has been to demonstrate clearly that, at *Bol'shoy Yakor' I*, these remains were formed as a result of repeated, seasonal visitation of a particular location by a single community. The almost precise superimposition of the hearths and scatters seen there and at *Ust'-Karenga*, might suggest that tent-poles were left *in situ* to be reused in subsequent occupations, a practice known from many ethnographic studies of hunter-herders in northern Eurasia (Grøn and Kuznetsov 2003).

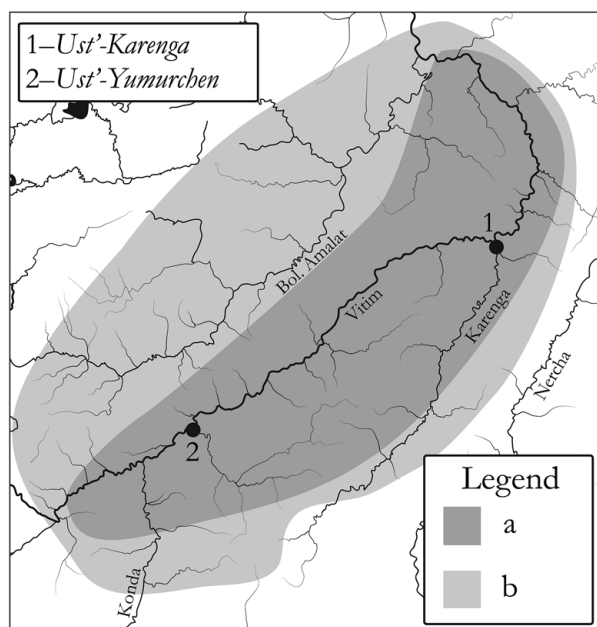
THE UST'-YUMURCHEN CULTURE; SITE STRUCTURE AND MATERIAL CULTURE

Cultural Distribution

At a regional scale, cultural material attributed to the Late Neolithic Ust'-Yumurchen culture has been far more widely recovered than that of the Early Neolithic Ust'-Karenga culture (Figure 3.6), and has been identified at most, if not all of the archaeological sites on the Vitim Plateau (Vetrov 1992). This may be partly an outcome of the proximity of its cultural deposits to the surface and its consequently greater representation in surface survey. However, in the absence of more widespread excavation, this proposition remains speculative. In general terms, the character of the cultural assemblage is described as similar to other Late Neolithic assemblages from sites across eastern Russia and closely related to contemporary archaeological cultures of adjacent regions, especially to the south and west (Vetrov 1992: 152). Yet, in spite of its wide distribution and interesting position within what is apparently a multi-regional cultural phenomena, there have been relatively few large-scale excavations of Ust'-Yumurchen cultural deposits in the Upper Vitim Basin, and the results available have been far less comprehensively described in the literature.

Site Structure

For various reasons, it is extremely difficult to discuss the horizontal distribution of artifacts in layers attributed to the Ust'-Yumurchen culture in any detail and unwise to draw any firm conclusions from the limited data available. Even



3.6. The approximate distribution of archaeological materials associated with a) the Ust'-Karenga and b) the Ust'-Yumurchen cultures.

at the most extensively excavated sites, which are, once again, the multi-layered site complexes of *Ust'-Karenga* and *Ust'-Yumurchen*, it is only possible to make a few general comments before moving on. Relatively few radiocarbon dates are available for the Ust'-Yumurchen culture, but those we have, based on the best-dated section at *Ust'-Karenga*, suggest that we should place the boundaries of the cultural phase between c. 4300 and 1400 cal BC.

At the level of the site complex, it is sometimes possible by looking at the overall distribution of material, to see shifts in the patterns of occupation within the local landscape. At *Ust'-Karenga*, for example, there seems to have been a partial shift in the focus of occupation from the right bank to the left. Certainly the majority of the ceramic material attributed to the Ust'-Yumurchen culture at *Ust'-Karenga* derives from the sites and findspots on the left bank. Yet, while such patterns are potentially informative, there are significant problems with the confidence of our interpretations even at this scale. To begin with, the shift in the distribution is far from complete and various post-depositional transformations and recovery biases leave open the possibility that the observed patterns are merely artifacts of geomorphological processes and our modern investigative foci and research agendas. Such problems are hardly unique to this site, but do need to be borne in mind as we go forward with this discussion and our analysis.

On a smaller scale, within individual sites/findspots, changes in distribution of artifacts could also be important. As in the earlier periods, the scatters of

lithics and ceramics in the upper levels are associated directly with other *in situ* evidence of occupation (charcoal concentrations, etc.). However, they do have a somewhat different character, having a greater overall volume of material and a more uniform horizontal distribution. Also in association with this material, a number of pit feature depressions were identified. Such features have not yet been identified in the horizons associated with the Ust'-Karenga culture. However, the combination of small excavation areas and higher artifact noise makes the identification and confident interpretation of patterns within these distributions more difficult. This problem is amplified by the issues of cross-contamination between these shallow sandy layers, predominantly due to deflation and bioturbation. Unsurprisingly, therefore, though there appear to be some differences in the site structure, the clearest differences between the two archaeological cultures are found in the material culture (by which these groups are defined) and since the Ust'-Yumurchen cultural assemblage is also dominated by lithics, it is here that the discussion begins.

Lithics

In technological terms, microblades and microblade production debris remain as core elements within Ust'-Yumurchen culture lithic assemblages, though the techniques of production and range of tool forms apparently differ in some important respects from those seen in the Ust'-Karenga culture horizons. Speaking generally, the transition can be characterized by the appearance of longer "tall forms" of wedge-shaped and prismatic nuclei, a wider range of scrapers and a greater quantity of arrowheads, the most characteristic of which are subtriangular "Daurian type" with a notched base (Vetrov 1995b, 2000). Other more subtle technological changes are also reported, though these would be almost imperceptible to the uninitiated if their emergence did not coincide with a far more dramatic change in the basic lithology of the stone-tool assemblage.

As a rule, stone-tool assemblages in the Upper Vitim Basin tend to be compositionally diverse, the result of using stone gleaned from widespread deposits of fluvio-glacial pebbles and cobbles – a practice well attested by the patches of water-worn "cortex" on many larger lithic artifacts (Vetrov 1992, 1995b). This kind of lithological variability is characteristic of stone tool assemblages attributed to the Ust'-Karenga culture, but is far less apparent in the lithics of the Ust'-Yumurchen culture, which appear more compositionally uniform and seem to reflect dramatic changes in tool-stone preference, source and pattern of acquisition.

The most striking difference is seen in a shift towards the exploitation of the transparent or slightly milky chalcedony and mottled, translucent, brownish-red carnelian. In some later contexts, these high-quality cryptocrystalline tool-stones account for between 60 and 100 percent of lithic fragments recovered,

yet they are virtually absent in previous periods (Vetrov 2000). It would be easy to imagine that this shift was an example of deliberate acquisition of this high-quality tool-stone from an “exotic” source, but it is worth noting that occasional nodules of chalcedony and carnelian can be found on the cobble bars around *Ust'-Karenga* today and may have been more common in the past. Ultimately, without further research, both interpretations are possible.

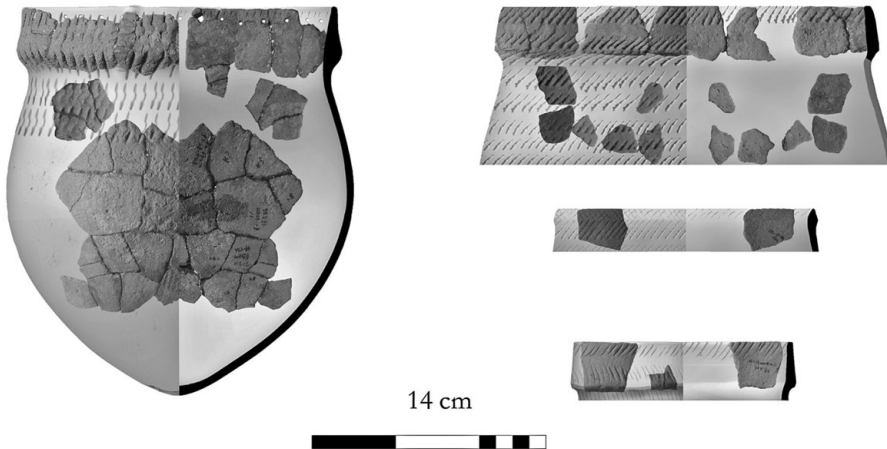
Other additions to the raw material repertoire have provided more concrete evidence for the existence of long distance interconnections, movement or exchange between the groups of the Lower, Upper and Middle Vitim Basin (Vetrov et al. 2000). These materials, which originate from discrete sources located far downstream, include “practical” tool-stones, such as rock crystal, specific varieties of argillite (previously identified as hyalodacite), as well as the precious green and white nephrite, which is frequently associated with high-status burials across Eastern Siberia, and graphite, which is an exotic material in the region (identified as originating from a source around 450 km to the north-northwest) and considered to have been a highly prized material in prehistory (Ineshin personal communication; Ineshin and Tetenkin 2017; Vetrov et al. 2000).

Although the available evidence suggests that such exotic materials were more characteristic of later Neolithic and Early Bronze Age assemblages within the Upper Vitim Basin, the earliest examples (possibly associated with layer 6 at *Ust'-Karenga*, though some doubt remains about this stratigraphic attribution) suggest that long distance exchange was already a feature of life during the later stages of the *Ust'-Karenga* culture. However, as layer 4 contained material consistent with both cultural phases, it is difficult to draw any certain conclusions about the precise “cultural” associations of these exotics.

Pottery

In spite of the fact that ceramic material attributed to this culture is encountered at virtually every site/findspot in the region, the *Ust'-Yumurchen* culture ceramic assemblage is substantially smaller than that of the *Ust'-Karenga* culture and is primarily composed of rim and upper body sherds collected as surface finds. It is also more varied and much less coherent as a group (Figure 3.7). At *Ust'-Karenga* it consists of just twenty-one vessels (confidently identified sherd groups). A further ten were recovered from *Ust'-Yumurchen* itself and eight from smaller findspots on the terraced banks of the Vitim, at *Nizhnyaya Dzhilinda/Ust'-Sivakon*, *Ust'-Konda*, *Ust'-Kholoj*, at *Ust'-Bugarikhtha* on the Karenga River and at *Ust'-Ashigly* and *Mongoj* on the *Bolshoj Amalat* (which runs immediately parallel and to the west of the Vitim's course).

As with the *Ust'-Karenga* assemblage, three other vessels are known and illustrated in the literature (Vetrov 1992), but for various reasons these could not be examined in the recent analytical study.



3.7. A selection of vessels attributed to the Ust'-Yumurchen cultural phase from sites across the Vitim Basin.

Potential compositional, or at least textural differences between the earlier pottery tradition and the Ust'-Yumurchen phase were noted in the primary reports, which describe both finer and coarser textured fabrics within this group (e.g., Vetrov 1985b). However, these differences were not recorded comprehensively, nor were they considered further at the time. Descriptions of the Ust'-Yumurchen ceramic styles have instead been characterized by brevity and a focus on formal, technical and stylistic differentiation in the ceramic traditions of the Ust'-Karenga and Ust'-Yumurchen cultures (Vetrov 2011).

Though persistently coil built and obovoid or parabolic in form, many of these later vessels are given a more "complex" profile (i.e., shouldered with an out-curving, thickened rim (Figure 3.7). This thickening of the rim, to create a triangular or rhombic profile, is considered to be one of the most characteristic features of this tradition. It was achieved either with the addition of a coil or band to the surface, or by folding over the rim. This practice was seen both on vessels with more complex profiles, where it typically added to the exterior, and vessels of a simpler form, where it projects into the interior (Vetrov 1992: 150).

Another key difference is seen in the form of "technical decoration." Although the exterior surfaces of most of the material attributed to the Ust'-Yumurchen culture have single-spaced, vertical linear markings, not entirely dissimilar to those seen on Ust'-Karenga vessels, these marks were produced in a very different way. They are the result of secondary forming using a grooved or, occasionally, cord-wrapped paddle. Surviving lower body fragments often showed smooth negative "facets" or rounded indentations on the interior surfaces, perhaps produced by a pebble anvil. The thin, compact walls and globular form of the vessels is also consistent with this technique. Traces of scraping or coarse wiping, which were seen on almost all of the Ust'-Karenga culture vessels, were very rarely encountered within the Ust'-Yumurchen material.

The “artistic” decoration of these later vessels is also quite different and attests to the use of a far wider range of decorative tools and a complete abandonment of the stepping-comb technique that was so characteristic of the Ust'-Karenga culture. Instead, Ust'-Yumurchen ceramics are dominated by regular horizontal rows of double- or single-spaced impressions of rectangular, oval or toothed stamps. This impressed decoration typically covers the upper part of the body at least as far as the shoulder. Another common feature of many vessels attributed to the Ust'-Yumurchen culture is the presence of a row of regularly spaced “perforations or deep pits,” made before firing, just below the rim (Vetrov 1992, 151). These are usually considered to be part of the decorative scheme, though they may perhaps have had some functional role, related to the attachment of a lid. Decoration of the interior surfaces, if present, is usually restricted to the rim area. In one case, evidence of plastic relief decoration at the rim was also identified.

Analysis confirmed that composition of the Ust'-Yumurchen culture ceramics was indeed different from the earlier tradition. Instead of using coarse primary or colluvial clays, the majority were made from much finer silty and sandy clays, often consistent with a secondary or alluvial origin. A clay resource survey in the immediate surroundings of *Ust'-Karenga* and more widely along the banks of the Karenga river revealed a close compositional match between widely available floodplain clays and the archaeological ceramics. These clays were most readily available across the post-glacial floodplain, however it is worth noting that deposits with almost identical composition were in older terrace bodies and should have been readily exploitable at the time of the Ust'-Karenga culture settlement of the site. Today these near-surface deposits, identified behind the village (at the edge of the old airfield) are actively exploited by the local community in the construction and repair of household ovens. The almost complete absence of exploitation of this resource in the production of Ust'-Karenga pottery would seem to require some further explanation.

Although the exploitation of fine secondary clay resources was a significant addition to the character of the Ust'-Yumurchen material, a considerable proportion of the Ust'-Yumurchen material, sampled at sites across the basin, was composed of coarser material. Some of this coarser material, when examined petrographically, proved to be consistent with some of the coarser fractions of the same secondary clay sources (which were often intercalated with sandy lenses), others appeared to be more like the primary/colluvial material used widely in the production of Ust'-Karenga pottery. However, in almost all of the cases where the findspots had a distinctive local geology, the mineralogy of ceramics clays was consistent with a local origin. It must, however, be noted that for most sites the sample size was too small to bring any confidence to this preliminary conclusion and further on-site surveying is urgently required to explore this matter further.

A CONFUSION OF "LATER" CERAMICS

Although we have presented a straightforward view of the cultural and ceramic sequence here, there is some further complexity to these assemblages that has not been discussed much in the literature. In layers 4–1 at *Ust'-Karenga* and in the upper layers of many other sites, we find the admixture of ceramics that display a comparatively wide range of technical production styles that do not fall into either of the relatively coherent traditions discussed here. These have been almost universally dismissed as later intrusive material and in many cases where distinctive styles, belonging to the Iron Age can be identified, this is quite clearly justified. However, it should not be assumed *a priori*. Clearly, this is a problem that can only be resolved through further research at sites where the stratigraphy for these later phases is better defined. Interestingly, in spite of its technological variability, a casual sample of this "later" material was analyzed alongside the other ceramic materials and proved to be virtually identical in compositional range to the ceramics of the *Ust'-Yumurchen* tradition.

DISCUSSION

Although the primary aim of this chapter is to present the main characteristics of the "Neolithic" ceramic traditions of the Upper Vitim Basin in a more comprehensive manner, it is important to set the results of this analysis within a wider interpretive context. Previous publications, often focusing on the establishment of chronology, have not explicitly considered the potential of the ceramic material as a window onto wider patterns of group behavior and mobility. Clearly, some of the characteristics of the pottery traditions encountered in the Upper Vitim Basin are valuable in this context.

Considering first the *Ust'-Karenga* material, it seems immediately clear that we should question the traditional correlation of ceramic production and sedentary life. There are various ways in which we could explain the compositional variety in the assemblage, but all of them require us to accept at least seasonal mobility around the valley by small groups who carried their pottery with them. The almost total absence of secondary alluvial clay resources, which are and were widespread and easily accessible across the valley floor, might be seen as a deliberate technical choice, perhaps related to a desire for better performance in use (see Hommel et al. 2015). However, a simpler explanation points us towards production in areas where these resources were simply not readily available. Assuming that the production of ceramics was primarily a summertime activity, which seems reasonable given the climate of the region, the "primary" character of the *Ust'-Karenga* culture ceramic assemblage might point us towards upland areas, away from the main channel of the Vitim. Notably, a 50 km radius drawn around *Ust'-Karenga* itself catches

significant geological variation in the uplands, which could encompass almost all the variation seen in the ceramic material.

The notion of mobility also fits well with the wider material assemblage and the distribution of finds on-site, as discussed earlier. The specific character of the tightly clustered remains suggest temporary occupation and the focus on micro-blades is at least plausibly consistent with autumn/winter settlement (Ineshin and Teten'kin 2010). The apparent superimposition of both hearths and ceramics of different compositions within single accumulations all seems to suggest that the groups of people who created these assemblages were attached to this place and occupied it repeatedly over a number of seasons as part of their wider strategy of landscape use, a practice that is well attested in many northern ethnographies (e.g., Grøn and Kuznetsov 2003). Of course, other interpretations, such as intergroup feasting or the acquisition of clay from intentionally distant sources are possible, but neither seems to fit so well with the evidence at our disposal.

The idea of mobility gains further traction when we consider the significant technical, compositional and decorative shift seen in later cultural phases. In this case, the evidence points strongly towards production and, presumably, settlement along the major channels of the Vitim during the summer months. Although we need to look more closely at the variation in alluvial deposits along the Vitim and its tributaries, with substantially less mineralogical variation in the material, and with more of the variation represented being consistent with local geologies, we might also consider longer duration settlement as a characteristic of this phase.

While our understanding of the pattern of the Ust'-Yumurchen culture settlement is far less developed, the more uniform distribution of material across the horizons, the presence of discernible pit structures (presumably associated with storage) and a shift towards a more targeted use of raw materials (including "exotics"), would be broadly consistent with this conclusion. Interestingly, indications of decreasing group mobility, storage and perhaps interregional exchange, are the first indication of the characteristics of so-called complexity in hunter-gather society, which in recent years has been tightly packaged with the initial emergence of ceramics (e.g., Hayden 2009). We have argued elsewhere (Hommel in press; Hommel et al. 2016) that this association in the literature has provided a conduit through which many traditional assumptions about pottery – developed when an agricultural context was assumed – have been maintained. The underlying assumption is that hunter-gather pottery was still considered to be atypical and inherently significant of social development and change; we would dispute this.

At *Ust'-Karenga*, the characteristics most closely associated with the appearance of complex hunter-gatherers apparently post-date the addition of pottery to the material repertoire significantly, perhaps by as much as 5,000 years. Instead, pottery appears to "emerge" without major changes to the pattern of life within a lithic assemblage that remains essentially consistent with the remains left by

other Upper Paleolithic communities further downstream, which apparently remained aceramic until the Middle Holocene (Ineshin and Teten'kin 2010). Although, by this stage, there is good reason to speak of long distance connections along the river basin. When pottery first appears in these communities it appears to be related to a separate northward dispersal of net-impressed pottery along the Lena River (Hommel in press; Ineshin and Teten'kin 2010). If we contrast this with the situation in other cultural contexts, such as the Natufian in the Near East, where detailed research has shown this pattern in reverse, with pottery entering a material repertoire and economic context in which many of the markers of "complexity" had already been present for millennia (e.g., Finlayson 2009), the notion of single explanations and uniform contexts for the adoption of pottery seem increasingly difficult to maintain.

Of course there are still many questions to be answered about this material, its place in our understanding of wider technological flows and the changing roles of pottery in hunter-gatherer societies. However, it is only by looking at the material and its context in tandem that we can hope to move beyond sterile technological description or empty debates about the chronologies of inevitable diffusion.

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FOUR

MARITIME NOMADS OF THE BALTIC SEA

Ceramic Traditions, Collective Identities and Prehistoric Cuisine

Sven Isaksson, Kevin Gibbs and Peter Jordan

INTRODUCTION

This chapter aims to examine how pottery traditions became caught up in the practice of culinary traditions and the expression of collective identities among the complex forager-farmer interaction zones that emerged along the western shores of the Baltic Sea between 3600 and 3300 cal. BC. The primary focus is the distinctive ceramic traditions that have been used by archaeologists to define the Pitted Ware Culture (PWC), generally thought to represent communities of marine-oriented foragers who made widespread use of pottery technologies.

Pottery was, as we now know, an innovation by hunter-gatherers, first emerging in East Asia between 18,000 and 10,000 cal. BC (Keally et al. 2004; Wu et al. 2012). For several millennia pottery seems to have been a relatively minor craft that did not expand far beyond the confines of East Asia (Gibbs and Jordan 2013; Craig et al. 2013). The initial establishment of ceramic container technology as a new invention has been shown to be associated with the processing of aquatic animal products (Craig et al. 2013). In at least one of the innovation areas, this specific use seems to have established itself as a cultural norm continuing for millennia (Lucquin et al. 2016). Eventually the hunter-gatherer pottery dispersed. One hypothetical route of dispersion goes across the continent via Siberia to Europe. Such a Hyperborean stream of pottery production could potentially account for all the early hunter-gatherer ceramic

traditions in eastern and northern Europe (Gibbs and Jordan 2013), though this remains to be seen.

Either way, around 5500 cal. BC the craft of pottery was transmitted among hunter-gather groups living in the eastern Baltic Sea region, spreading swiftly throughout a region stretching from the northeasternmost part of Norway in the north, to northern Poland in the south (Hallgren 2009). Not much is known about the use of this early pottery but a few vessels from Finland of the Pit-Comb ware, the classic northern hunter-gatherer pottery of northeastern Europe, have been analyzed and found to be primarily used for the processing of aquatic animal products (Cramp et al. 2014). Early Comb Ware and Jäkärilä Ware vessels have been found to be used for both aquatic and terrestrial animals (Pääkkönen et al. 2016).

On the borders of the Scandinavian Peninsula this early uptake of pottery technology among northern hunter-gatherer cultures came to a sudden halt, creating a western boundary that was to remain for more than a millennium (Hallgren 2009). Only from the southernmost coasts of Sweden are there sites with early Ertebølle pottery. When pottery was introduced more widely around 4000 cal. BC it came from the south as the style known as Funnel Beaker or TRB pottery, and it spread swiftly. Eastern central Sweden is one of the northernmost regions with archaeological remains that can be classified as TRB. The TRB sites in eastern central Sweden are found both on the coast with remains of fishing and seal hunting, and inland with remains of domesticated animals and cultivated plants (Knutson and Knutson 2003). The TRB is therefore associated with the introduction of agriculture to the region and an analysis of TRB pottery use at one site in this northern TRB borderland shows evidence of both dairying and the processing of aquatic products (Isaksson and Hallgren 2012). The varied vessel use and the presence of dairy products already in this first phase of the Scandinavian Neolithic are in agreement with a study on TRB pottery from Denmark and northern Germany (Craig et al. 2011).

The PWC pottery style (Figure 4.1) started to emerge in the archaeological record after 3600 cal. BC in eastern central Sweden and is thus, to some extent contemporary with the TRB (Edenmo et al. 1997). In early research the PWC pottery and its associated material culture was recognized as a distinct and homogeneous coastal hunter-gatherer culture group with an emphasis on marine mammal hunting and fishing (e.g., Löfstrand 1974).

THE PITTED WARE CULTURE: NOMADS OF THE BALTIC SEA

What the different pottery styles and their associated material remains represent has been lively debated – ritual or economic specializations of the same group, separate ethnic or cultural groups, genetically different populations, etc. (Björck 1999, 2003a, 2003b; Gill 2003; Eriksson et al. 2008; von Hackwitz

2008; Linderholm 2008; Larsson 2009; Malmström et al. 2009; Østmo 2010; Fornander 2011; Glørstad 2012; Skoglund et al. 2012, Brink et al. 2015; Andersson 2016). Some have argued that there was a gradual shift from TRB culture to PWC (Seegerberg 1999; Strinnholm 2001; Larsson 2009, 2011), possibly representing a reintroduction of the hunter-gatherer lifestyle (Sundström 2003; Knutson and Knutson 2003). But clear influences on the PWC pottery have come from the eastern Pit-Comb ware (Larsson 2009, 2011). Typical PWC pottery diverges markedly from the TRB not only in shape, but also in aspects of temper, clay and construction techniques (Larsson 2009; Hallgren 2011), indicating the presence of different technological traditions (Larsson 2008).

PWC vessels appear in a range of shapes and sizes (Figure 4.1). However, the dominating shapes are conical vessels with carinated, straight or slightly convex shoulders (Papmehl-Dufay 2006). The sizes range from large pots, about 0.5 m in diameter, down to miniature vessels of only 0.05–0.1 m in diameter. Clay discs are also encountered in the assemblages. The vessels commonly have pointed or rounded bases, though flat based vessels also occur. The décor was chiefly applied in horizontal rows on the upper parts of the vessels, around the shoulder and at the neck, though decorations on the rim and the entire body do occur as well (Bagge 1951; Papmehl-Dufay 2006; Larsson 2009). The most noticeable decorative features are of course the incised pits, giving the style its name, but other patterns such as herringbone motifs, cross-hatching, vertical or angled short lines, comb impressions and other forms and incisions do frequently appear. The decorations appear in a wide range of different combinations and in such cases the pits commonly cut across the other decorative patterns (Papmehl-Dufay 2006; Larsson 2009). The PWC pottery itself also varies between sites and possibly even between individual potters, but each of these still lead to a product that is recognized as a PWC pot, both by researchers today and by the people who originally used them (Papmehl-Dufay 2006; Brorsson et al. 2007; Larsson 2009).

PWC sites are found in several parts of Scandinavia but eastern central Sweden is the core region. Typically, PWC sites are located close to the contemporary shoreline, and are distinguished by the large amounts of pottery



4.1. Reconstructed vessels from Högmossen, Sweden, (site no. 1 in Figure 4.3). The vessels could be partially reassembled from the base through to the rim using archaeological sherds; full reconstructions were completed digitally (digital imaging: Maria Ytterberg). Rim diameters of the vessels in the image vary from 10 cm for the smallest to 34 cm for the largest. Sherds from these vessels have been analyzed and the lipid residues of all vessels were dominated by aquatic animals with traces of residue of vegetable origin, with the exception of the large vessel in the back from which no lipid residues could be extracted. This large vessel may have been used for storage or as a water container. (after Björck and Hjartner-Holdar 2008: 232, reproduced with permission)

found. The bone materials at the sites are dominated by fish and seal bones, even though bones from terrestrial animals such as bear, deer and pig/boar do occur. Finds of charred remains of nuts, and of herbs and roots, which may be the remains of plant foods, are fairly frequent. There are also sporadic finds of charred cereals at PWC sites and equally rare imprints of seeds in PWC pottery (e.g., Heimdal 2007; Edenmo and Heimdal 2012; Gustafsson 2013). Doubts have been expressed as to the significance of such finds (Björck and Larsson 2007), but they have also been inferred to reflect a PWC practice of a rare and very small-scale growing of seeds for ceremonial use rather than for subsistence (Edenmo and Heimdal 2012). Fairly common finds are various stone tools and debitage as well as anthropomorphic and zoomorphic figurines. Typical features found at PWC sites are pits and hearths, but also human burials and structures interpreted as hut remains (Wyszomirska 1984; Edenmo et al. 1997; Segerberg 1999; Isaksson et al. 2002). Not all these features are present at all sites, and there are sites where no obvious hearths have been identified.

Burials are fairly common on PWC sites and human skeletal remains found contextually associated with the PWC pottery style and its associated material culture have been subjected to a number of dietary studies, based on stable carbon and nitrogen isotope analyses of bone collagen and dentine. These studies show evidence of a fairly homogenous diet dominated by proteins of marine animal origin. This is in stark contrast to individuals contextually associated with the TRB style and associated material culture, showing a much more terrestrial base of the diet (Lidén and Eriksson 2007; Eriksson et al. 2008, 2013; Fornander et al. 2008; Fornander 2011). It is therefore clear that the human remains that can be contextually associated with these two different pottery styles represent people with two quite different diets and lifestyles, including fundamental differences in food procurement strategies.

The large amounts of pottery at many PWC sites may suggest that it was produced and used on-site. A known practice among nomadic hunter-gatherers is the investment in technologies for food processing, such as ceramic containers, at seasonal base camps. Indeed, technical analyses of the ware of PWC pottery have shown a strong correlation with geographical location indicating local retrieval of materials for pottery manufacture among PWC potters in eastern central Sweden (Brorsson et al. 2007). This would seem to indicate that pottery was made, used and even cached for re-use at particular sites, and that these locations were revisited on a predictable basis as part of an otherwise highly mobile world of seafaring. The proposed small-scale growing of seeds could also have involved only brief stays during the planting and growing seasons, and posed no major obstacle to maintaining a nomadic lifestyle (Edenmo and Heimdal 2012). A characteristic of many PWC sites is the exposure toward large surfaces of open water (von Hackwitz 2009), having their focal points towards the open sea (Figure 4.2). This also implies that the

sites were easy to locate from the water. This suggests a predominating marine means of conveyance. The same study also shows that many PWC sites are located on eskers, offering sandy beaches at the waterfront. These ridge-formed glacial deposits are geological features long known for generating an abundance of freshwater springs. The access to trusty sources of clean freshwater would certainly be vital to nomadic marine hunter-gatherers.

Both the location in the landscape, the lack of remains from proper buildings and the odd mixture of apparently ordinary settlement materials (hearths, pits, potsherds, stone tools and debitage, animal bones) on the one hand, and both stray-finds of occasional human bones as well as proper burials on the other, have led researchers to question the interpretation

that these sites are regular settlements, instead suggesting that they are ritual and cultic gathering sites instead (Carlsson 1998; Gill 2003). And, indeed, at sites of other sedentary coastal hunter-gatherers, such as the Okhotsk culture in Northeast Asia, the remains of robust buildings, delimited kitchen-middens and separate ceremonial areas are found (Smale 2014). However, the mixing of settlement activities and burial remains at the PWC sites suggests no explicit spatial differentiation between routine and ritual activity areas. It could possibly be explained by the fact that the sites may have served as a temporary landing places to which sea nomads – who otherwise spent most of their time in marine voyaging – occasionally returned to in order to perform both routine activities and funerary or ritual events. With imperfect memory of exactly where on the site each activity was previously performed, seemingly odd mixtures of remains could have accumulated over multiple visits.

Further, recent DNA studies show that there is a separate biological descent associated with the PWC group in comparison with other contemporary groups (Linderholm 2008; Skoglund et al. 2012). Human remains contextually associated with PWC pottery and associated material culture show a close genetic affinity to a group of Mesolithic human remains found across Europe in contexts with material remains typical of hunter-gatherers, while individuals found with TRB materials share a close genetic affinity to human remains from Central Europe found in contexts with the material remains of an agricultural lifestyle (Malmström et al. 2015). It is clear, therefore, that the early PWC group were marine foragers living in a wider world of farmers and other groups.



4.2. View of the Baltic Sea, as seen from Vaddö in the Stockholm archipelago with the Åland islands of Finland beyond the horizon. During the Neolithic period the archipelago of eastern central Sweden was a complex maze of waterways made up of small inlets, islands and skerries. Sites of the Pitted Ware Culture typically consist of sandy waterfront beaches that face out onto large bodies of open water. Photo: Gitte Ekdahl, reproduced with permission

In the meeting with others the need for clear articulation of collective identity increases. Group affiliations usually include both shared culture (material and non-material) and kinship or descent (perceived and/or biological). We may hypothesize that material culture (including pottery style) was a vital part of the formation of a collective identity for the PWC group. Without doubt, they had contacts with other groups and must have been familiar with the agricultural lifestyle but refused to adopt it, perhaps in order to affirm their choice.

POTTERY TRADITIONS, COLLECTIVE IDENTITIES AND PREHISTORIC CUISINE

In hunter-gatherer research there is a tendency to think of food as forager adaptation and basic survival; humans eat to get the essential nutrients in order to stay alive. Through human history people have tried to eat almost everything (e.g., Eidlitz 1971; Davidson 1999; Kiple and Ornelas 2000), but equally characteristic of human feeding behavior is to not consider everything around as edible. The decision on what constitutes food is utterly subjective, and in the end governed by culture. This can result in certain foods gaining both dietary and cultural significance, becoming a staple or core food of a food culture. Of course, taste and smell are strong sensory impressions, but how people react to specific tastes or smells is something people learn from others and through experience. One specific taste or smell may cause the mouth to water for one person and be sickening to another. Shared relations to tastes and smells contribute strongly to feelings of identity within a social group, a food culture. The encounter with unfamiliar tastes and smells when on a visit contributes strongly to the feeling of not being at home.

The culture of food involves facts and ideas, ideals, conceptions, convictions and ideologies concerning food and eating, and also the ways all this is used and accumulated, as shared by groups of people (Lévi-Strauss 1978; Douglas and Isherwood 1979). Making use of culture, people produce and utilize objects, constructions and landscapes, and groups of people may develop distinct styles through difference of use. Recognizing these styles contributes strongly to the comprehension of a collective identity – things actively influence human perception and behavior. Styles of cooking practice, including choices of foods, methods of preparation, flavor principles, rules for consumption, and strategies of food procurement – characteristic for different groups of people – are defined as separate cuisines (Farb and Armelagos 1980; Mintz 1996). Different cooking techniques have distinct effects on palatability and flavors, and relations to tastes and smells are fundamental aspects of different cuisines. The material culture of cooking, e.g., pottery, is thus a key aspect of this. The concept of cuisine operates on many levels and several dimensions, and

can be distinctive for both large regional groups of people and for smaller social groups. Food group identities that have been recognized earlier in food studies are for example, gender (Newcombe et al. 2012), ethnicity (Carrus et al. 2009) and family (Cong et al. 2013), just to mention a few. Cuisine is culturally transmitted from early childhood and hard to change once it has become customary. Even when people migrate into new territories, an accent of native cuisine is likely to be retained (Belasco 2008; De Backer 2013).

Archaeological approaches to cultural identity have been discussed intensively during the past quarter century (e.g., Shennan 1989; Damm 1991, 2006; Jones 1996, 1997; Hallgren 2000, 2008). The remains of material culture, be it pieces of landscape, constructions or objects found in the archaeological record, are by no means the only “cultural diagnostics,” but non-material culture such as cuisine also forms a vital part of the formation of a collective identity. Indeed, as food habits are so closely tied to cultural and social identity, they might even have been a stronger articulation of collective identity among prehistoric people than any of the artifacts customarily used by archaeologists for attribution to an archaeological culture. Though pots are not people, it is people that both produce and use the pots, and in so doing express fundamental aspects of collective identity in both cooking practice and in pottery style. And when changes in the use of pots are recorded in an archaeological material it may reflect a change in the cuisine of the people using the pots, or a change in the people using the pots.

If we accept that the choice of cooking technique has a profound impact on fundamental aspects of cuisines, and that cuisines are hard to change once they have become customary, then we can make a few predictions. If the PWC and TRB vessels were used by the same group of people we would expect to find similarities in the use of the different pottery styles. If there was a gradual shift from TRB culture to PW culture then we would expect there to be a gradual shift in pottery use as well. But from the evidence presented in the previous section it seems unlikely that the PWC pottery style emerged as a result of an adoption from farmers, like the producers of the TRB. If the unique style of PWC pottery and its use were an expression of a collective identity through food in the meeting with others (i.e., the TRB culture), then the traces of use should also be distinctive between the early PWC pottery and the TRB pottery.

LIPID RESIDUE STUDIES OF EARLY PWC AND TRB POTTERY

When ceramic vessels are used for the processing of food products, they may absorb lipids, forming residues that today are recognized as valuable source materials in archaeology (Evershed et al. 2001; Evershed 2008a). The composition of such lipid residues will depend both on what foodstuffs were

processed, how and for how long the pot was used and to some degree the burial conditions (Evershed 2008b).

The perceived functional link between pottery and farming in earlier research (Barker 2006) has also influenced biomolecular studies, with a strong focus on the tracing of agricultural products (Dudd and Evershed 1998; Copley et al. 2005; Craig et al. 2005; Spangenberg et al. 2006; Evershed et al. 2008; Gregg et al. 2009; Isaksson et al. 2010; Dunne et al. 2012; Isaksson and Hallgren 2012; Salque et al. 2013). How hunter-gatherer groups used their pottery is a much more recent line of enquiry (Isaksson 2009; Craig et al. 2011, Craig et al. 2013).

With the molecular analysis that we apply (precise experimental details can be found elsewhere (e.g., Isaksson and Hallgren 2012), it is possible to identify lipids from terrestrial animals (T), aquatic animals (A) and from vegetables (V). The detection of cholesterol or any decomposition product of it is evidence of animal lipids. Cholesterol may also derive from human fingerprints, but in recent contaminations is accompanied by the polyunsaturated hydrocarbon squalene, which is easily identified (Dimc 2011; Weyermann et al. 2011). Samples containing squalene should always be discarded since human skin lipids and fingerprints not only contain cholesterol but also an abundance of fatty acids that would ruin any molecular or isotopic analysis of these compounds. A fatty acid distribution characterized by a high ratio (>0.5) of the fatty acids stearic (C18:0) to palmitic (C16:0) acid is indicative of a large contribution from terrestrial animal lipids (Isaksson 2000; Olsson and Isaksson 2008). Identifying plant lipids in archaeological residues is not straightforward (cf. Steele et al. 2010), but the following markers do indicate contributions from vegetables; the presence of phytosterols (stigmasterol, campesterol, β -sitosterol), waxes or wax residues (long-chain fatty acids, alkanols and alkanes) (cf. Charters et al. 1997) or a fatty acid distribution characterized by a low C18:0/C16:0-ratio (Olsson and Isaksson 2008). Certain polyunsaturated fatty acids may be transformed to ω -(*o*-alkylphenyl)alkanoic acids when heated (Matikainen et al. 2003). Vegetable oils are rich in C18 polyunsaturated acids and C18 ω -(*o*-alkylphenyl)alkanoic acids is therefore an indication of this in a prehistoric sample (Isaksson et al. 2005). Marine animal oil residues are rich in C16–C22 ω -(*o*-alkylphenyl)alkanoic acids and should also contain at least two isoprenoid alkanoic acids and have a fatty acid distribution characterized by a low C18:0/C16:0-ratio (Hansel et al. 2004). Fish lipids may also leave traces in the form of a low C18:0/C16:0-ratio together with the presence of cholesterol (Olsson and Isaksson 2008). One of the two isoprenoid alkanoic acids, i.e., phytanic acid, may also be produced through the decomposition of chlorophyll. As such it may indicate the presence of green plants, but phytanic acid is also found in milk and dairy products as well as seafood (Schröder and Vetter 2011). During use free fatty acids in the vessel wall may react and form

long-chain ketones, but at temperatures higher than during normal cooking (Evershed et al. 1995, Evershed 2008b). Further, pottery may not only be used for food, but for the storage and processing of tars, pitches, etc. (Isaksson 2009).

Lipid residue analyses have been performed on pottery from a range of sites with early PWC and TRB in Sweden (Figure 4.3 and Table 4.1). These results show that in the 116 PWC vessels included in this study at least two of the C16–C22 ω -(*o*-alkylphenyl)alkanoic acids (at least one C > 18) were found in 28 (24.1%) of the samples and at least two of the isoprenoid alkanolic acids were detected in 32 (27.6%) of the samples, both indicating contribution from aquatic animals, while only 21 (18.1%) had a high C18:o/C16:o-ratio indicating contribution from terrestrial animals. For the 127 TRB vessels analyzed there are at least two of the C16–C22 ω -(*o*-alkylphenyl)alkanoic acids (at least one C > 18) in only 3 (2.4%) of the samples, at least two of the isoprenoid alkanolic acids were detected in only 7 (5.5%) of the samples, and no less than 69 (54.3%) samples had a high C18:o/C16:o-ratio indicating contribution from terrestrial animals. This shows without doubt that there are distinct differences in pottery use between these two different pottery styles.

DISCUSSION AND CONCLUSIONS

Already in early research the PWC pottery was considered the product of a distinct coastal hunter-gatherer group with marine mammal hunting and



4.3. Location map of sites included in this investigation; for further details, see Table 4.1.

TABLE 4.1. *List of sites and samples included in the current investigation. The map reference number refers to the locations of the sites shown in Figure 4.3. Pottery styles: TRB = “Funnel Beaker”; PW = “Pitted Ware.” Abbreviations of archaeological periods: EN = “Early Neolithic” (4000–3300 cal. BC, divided into EN I (4000–3500 cal. BC) and EN II (3500–3300 cal. BC)); MN = “Middle Neolithic” (3300–2300 cal. BC, divided into MN A (3300–2700 cal. BC) and MN B (2700–2300 cal. BC)). The references cite where the analyses were first reported.*

Site	Map reference number (Figure 4.3)	No. of samples	Pottery Style	Period	References
Alby	10	14	TRB	EN	Palomäki (2006)
ESS	13	48	TRB	EN	Isaksson and Erdős (2014)
Herrestorp	14	15	TRB	EN	Isaksson and Papakosta (2013)
Resmo	11	10	TRB	EN	Papmehl-Dufay et al. (2013)
Runsback	9	10	TRB	EN	Papmehl-Dufay et al. (2013)
Skogsmossen	3	8	TRB	EN	Isaksson and Hallgren (2012)
Stensborg	4	8	TRB	EN	Dimc (2011)
Tröslå	6	14	TRB	EN	Ohlberger (2009)
Total TRB		127			
Högmossen	1	16	PW	EN II / MN A	Isaksson (2008a)
Postboda S	2	10	PW	EN II / MN A	Brorsson et al. (2007)
Postboda 2	2	10	PW	EN II / MN A	Brorsson et al. (2007)
Korsnäs	4	19	PW	MN A	Dimc (2011)
Köpingsvik	8	18	PW	MN A	Papmehl-Dufay (2006)
Ottenby	12	14	PW	MN A	Papmehl-Dufay (2006)
Postboda 1	2	10	PW	MN A	Brorsson et al. (2007)
Sittesta	5	10	PW	MN A	Isaksson (2008b)
Tröslå	6	9	PW	MN A	Ohlberger (2009)
Total PW		116			
Overall Total		243			

fishing as their economic base. The PWC were hunter-gatherers who made use of pottery that they had adopted from elsewhere. But even though pottery producing coastal hunter-gatherers are no longer unheard of, the inference that the PWC was a distinct coastal forager group is still occasionally questioned. What may be odd and potentially confusing with the eastern Swedish material is the fact that these hunter-gatherers were not the first pottery

producers in the area; that was instead the TRB. As the TRB is associated with the introduction of agriculture, this local sequence is in line with the old conception of a universal and functional link between pottery and farming. It is also in line with a universal sequence of going from hunter-gatherer to farmer, i.e., stages in a social evolution ladder.

If the early PWC represented a conscious reintroduction of a local old hunter-gatherer ideology and economy among previous TRB users, the cuisine associated with the PWC should be similar to a local Mesolithic cuisine, understood to be that of a typical hunter-gatherer lifestyle. But even if this Mesolithic cuisine contained a distinct marine element, the hunter-gatherer cuisine associated with the PWC obviously includes a cooking technique (i.e., ceramic container technology) absent among the local Mesolithic hunter-gatherers. Of course, one can think of it as old foods with deep significance now cooked and served in new ways. But different cooking techniques are not interchangeable, they are not just different ways of heating a meal. It would not in that case be a reintroduction of old hunter-gatherer foods but the invention of new ones. Except for the emergence of PWC to represent any transition among previous TRB users, then this shift is extremely sudden and obviously incomplete since there are contemporaries continuing with the more terrestrial diet. It is not a very convincing explanation.

What we see may of course also be the remains of continuity in food culture but with a new container technology, borrowed from farmers, but used in a hunter-gatherer life world, in ways that draw on deeper and older aquatic food traditions. However, to the east, just across the Baltic, there is the Pit-Comb ware, produced and used by hunter-gatherers. As already mentioned, there are clear influences on the PWC pottery from the Pit-Comb ware, suggesting that this may be the ultimate source of the PWC pottery tradition.

We postulated earlier in the chapter that cuisines are closely tied to cultural and social identity, being very strong indicators of collective identity among prehistoric people. In addition to specified core foods, particular cuisines also favor well-defined sets of cooking techniques with distinct effects on palatability, flavors and nutritional value. The reported analyses of food lipid residues in the ceramics provided direct evidence of food processing as well as indications of core food, for the PWC it is aquatic animals, and for the TRB, terrestrial animals.

The core food signal from pottery needs, however, to be tested against other evidence since there are many ways to prepare food other than to cook it in a pot. Bone food waste is one such material. At both PWC and TRB sites, bones of both aquatic and terrestrial are found. Diet is in this context an important piece of information when trying to identify prehistoric cuisine since it provides evidence of which protein-rich foods dominated the diet of the analysed individuals over periods of several years of their lives. This is ideal in order to identify protein-rich core food of a population since we can be positively sure

that it has been eaten and has dominated that part of the diet. Here we could show that the pottery use is in accord with earlier dietary studies.

The emphasis on aquatic resources in the earliest hunter-gatherer pottery in East Asia (Craig et al. 2013) seems to be a common trait with later pottery using hunter-gatherers in the Baltic, the Ertebølle (Craig et al. 2007) and the already mentioned Pit-Comb ware (Cramp et al. 2014). There are of course vast uncharted territories regarding pottery-use between the Northeast Eurasian Jomon and the Northwest Eurasian Ertebølle, and Pit-Comb ware assemblages, but we can use the observations as a starting point for deduction. It may very well have been the rich access to aquatic foods in highly productive aquatic ecotones that provided the initial impetus in East Asia for investment in ceramic container technology (Craig et al. 2013). The innovation and introduction of a new cooking technique always, by definition, also involves a change in the characteristics and appearances of the food prepared with the new technique. Further, when pottery was introduced, it was initially as a prestige technology with a limited range of uses for special foods for aggrandizing or competitive feasting (Lucquin et al. 2016). These aspects together cause a strong cognitive connection between the special foods and that specific cooking technique, with very little real functional significance. As pottery production slowly intensified in the core areas it also became more deeply embedded in social life and subsistence activities. The advantages it conferred on the communities that were making and using pottery, both as a functional tool and a symbolic object, made it attractive to other groups who adopted it into their technological repertoires (Gibbs and Jordan 2013) and into their culture of food. From this we can hypothesize that when the hunter-gatherer pottery technology dispersed from East Asia and via Siberia into Europe, it did so together with ideas on limitations on how and what this cooking technique was to be used for.

For the PWC group we have identified both material culture, e.g., the pottery style, and non-material culture, i.e., cuisine, as vital parts in the formation of a collective identity. The early Pitted-Ware pottery-use is characterized by a high contribution of aquatic animal residues. We find a clear association of pottery style, pottery-use and diet, signifying a separate marine hunter-gatherer food culture. The food cultural dissimilarity between the early PWC and the TRB is so clear that they must be considered as two separate groups with separate routes of dispersal, the TRB coming from the south and the PWC from the east. The stylistic links between the Pit-Comb ware and the PWC has already been attested (Larsson 2009). So, rather than being a purely local development in eastern Scandinavia, we may hypothesize that the PWC hit the western shores of the Baltic Sea around 3600 cal. BC as a final swell of the Hyperborean stream of hunter-gatherer pottery, picking up local

elements and becoming a unique hunter-gatherer pottery tradition used in coastal settings. The cause of events may very well vary between different regions, for example in the south and west of Scandinavia (cf. Jennbert 2015) as compared to the east coast. And what happens with the PWC later in the Neolithic is quite another story.

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FIVE

THE PARADOX OF POTTERY IN THE REMOTE KURIL ISLANDS

Erik Gjesfeld

5.1 INTRODUCTION

Archaeological research on pottery technology has traditionally emphasized the importance of agriculture, sedentism and population size to explain the adoption and use of ceramics (Eerkens, Neff and Glascock 2002). However, evidence accumulated in recent years disputes these traditional explanations by highlighting the widespread production and use of pottery by small-scale, semi-sedentary, hunter-gatherer communities (Jordan and Zvelebil 2009). This chapter contributes to the growing knowledge of hunter-gatherer pottery technology by investigating the manufacture and use of ceramics among maritime foragers in the remote Kuril Islands of Northeast Asia. In these islands, foraging populations produced pottery for nearly three millennia despite strong environmental limitations. This work explores the question of why Kuril populations continually produced and used pottery in this remote and challenging environment. Results of the research suggest that pottery was not only used in cooking activities but also served as an important technology for the production of marine oil and the economic livelihood of Kuril inhabitants.

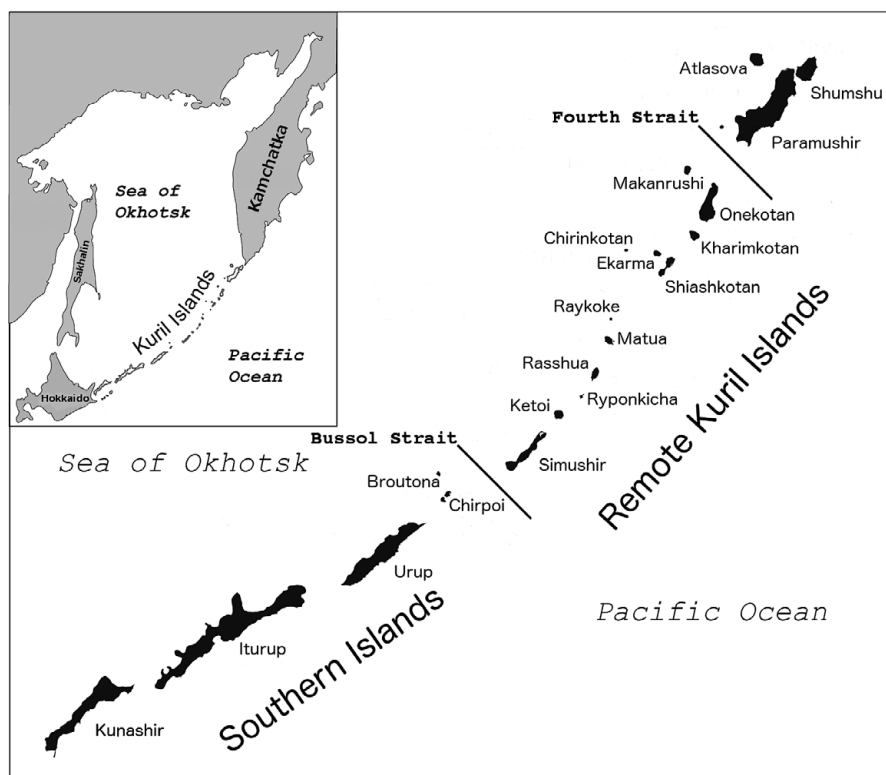
5.2 THE REMOTE KURIL ISLANDS

5.2.1 *Biogeography*

The Kuril Islands are located in Northeast Asia and include thirty-two islands varying in size from 5 km² to 3,200 km². The archipelago stretches in line for

almost 1,200 km, from the island of Hokkaido in the south to the Kamchatka peninsula in the north. The most significant geographic features of the Kuril Islands are the large and numerous open-water straits between islands. The largest of these is the Bussol Strait, which has a significant influence on the biogeography of the island chain (Pietsch et al. 2003; Fitzhugh et al. 2004). Islands south of the Bussol Strait (Kunashir, Iturup and Urup) maintain significantly higher biological diversity based on their large island size and proximity to Hokkaido. This trend is most clearly observed in the flora of the archipelago, with the southern islands having abundant trees and shrubs, including spruce, larch and oak as compared to the tundra-covered islands located north of the Bussol Strait (Anderson et al. 2008). The distribution of fauna also highlights this biogeographical pattern, with the southern islands containing a wide diversity of terrestrial mammals (Hoekstra and Fagan 1998), insects, mollusks and fish (Pietsch et al. 2003, 2001).

In this chapter, focus will be placed on the remote Kuril Islands, which are defined here as the set of islands bounded by the Bussol Strait to the south and the Fourth Strait to the north (see Figure 5.1). These islands, while ecologically less diverse and smaller than the southern islands, do contain high abundances of



5.1. Map of the Kuril Islands with names of islands, straits and regions discussed in the text. (base map originally drawn by A. Freeburg)

marine mammals, particularly sea lions, seals and sea otters (Burkanov and Loughlin 2005). The abundance of marine mammals in the remote Kuril Islands was first documented by European explorers, such as Captain Snow (1897), who in 1855 described eighteen different rookeries with up to 100,000 sea lions “hauled up” during the summer months. The modern climate conditions of the remote Kuril Islands are strongly influenced by northwestern winds deriving from Siberia (Leonov 1990). These winds help deliver nearly 138 snowstorm days per year and stable snow cover from November until May (Ganzei et al. 2010). Summers are typically short and characterized by dense fog and very high air humidity (Fitzhugh et al. 2002; Razzhigaeva et al. 2009; Ganzei et al. 2010).

5.2.2 *History of Archaeological Research*

The isolated location of the remote Kuril Islands has long proven to be a significant barrier in performing systematic archaeological research. The first European knowledge of this remote region came in the form of diaries and reports from explorers, hunters and traders in the seventeenth to nineteenth centuries. Two of the most prominent contributors from this period were Georg Wilhem Steller (1709–1746) and his student Stepan Krasheninnikov (1711–1755). Their combined works (Krasheninnikov, 1963, 1972; Steller, 1899, 1988, 2003), provide some of the earliest accounts of the social practices, house structures, trading practices and hunting methods of foraging communities from around the Sea of Okhotsk. Nearly 100 years later, Captain H. J. Snow, a prolific sea otter hunter, led an expedition into the remote Kuril Islands that detailed the geography, flora, fauna, geology and Ainu inhabitants of the island chain. He chronicled his travels in the book *Notes on the Kuril Islands* (Snow 1897).

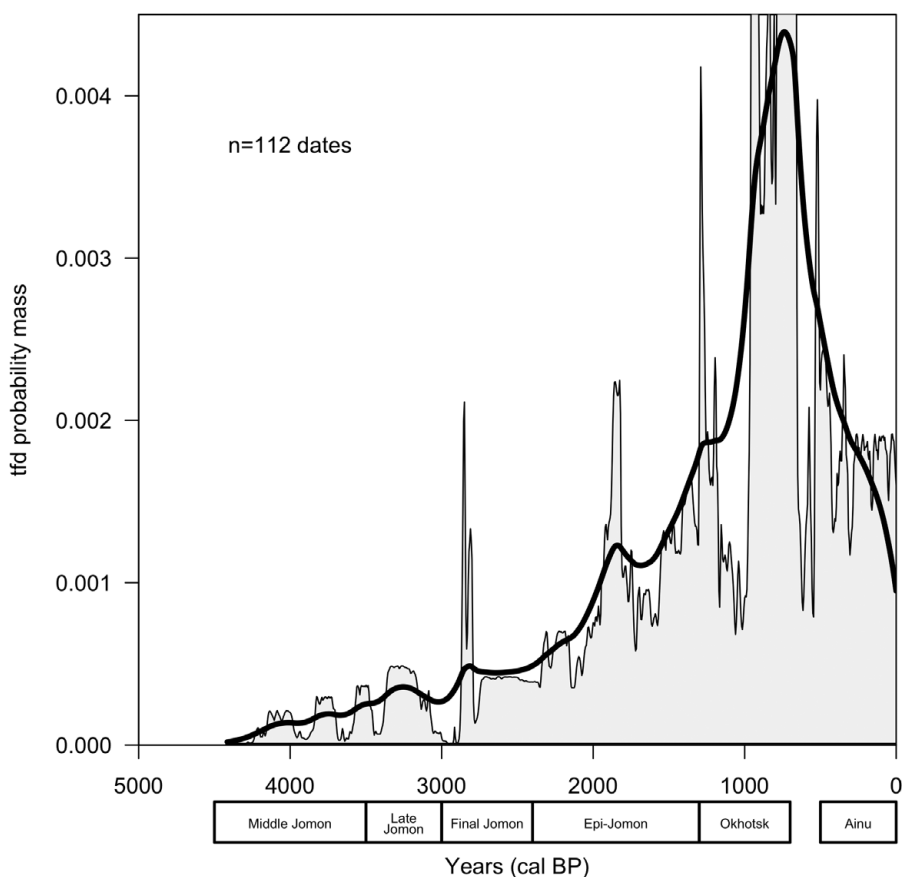
While systematic investigation of the northern and southern regions of the island chain were performed by Japanese, American and Russian archaeologists over the last 100 years (Torii 1919; Baba, 1934, 1939; Chubarova 1960; Befu and Chard 1964; Golubev 1972; Knozorov et al. 1989; Zaitseva et al. 1993; Shubin 1994), extensive archaeological research was not performed in the remote Kuril Islands until the late twentieth century. Beginning with the International Kuril Islands Project (IKIP) lasting from 1994 to 2000 and culminating in the Kuril Biocomplexity Project (KBP) extending from 2005 to 2012, the remote Kuril Islands became the central focus of large-scale interdisciplinary research that investigated fundamental questions concerning the geological, ecological and cultural history of the archipelago.

5.2.3 *Occupation History*

Based on archaeological evidence and radiocarbon dates, (Fitzhugh et al., 2002, 2004, 2016; Kuzmin et al. 2012), three main occupation periods of the remote

Kuril Islands are commonly recognized. While the earliest pottery remains in the southern region extend to nearly 8,000 years ago (Zaitseva et al. 1993; Yanshina and Kuzmin 2010), it is not until approximately 4000 cal BP that the first occupation of the remote Kuril Islands takes place. Given the increased reliance on marine resources in northern Japan and Hokkaido during the Late and Final Jomon (Yamaura 1998; Habu 2004; Kusaka et al. 2008), it is not surprising that the earliest archaeological evidence in the remote Kuril Islands is associated with these periods. Based on the frequency of radiocarbon dates shown in Figure 5.2, population density during this early occupation period remained relatively low (see Fitzhugh et al. 2016 for details on the estimation of population density from radiocarbon dates).

The first consistent occupation north of the Bussol Strait is generally recognized to occur just after 3000 cal BP (Niimi 1994; Fitzhugh et al.



5.2. A temporal frequency distribution (tfd) of summed radiocarbon probabilities from the remote Kuril Islands used to estimate population density. The summed probability distribution is shown in grey and the black line represents the smoothed kernel density estimate. See Fitzhugh et al. (2016) for additional details about the analysis of the radiocarbon dates.

2002). Based on stylistic similarities in pottery, the populations occupying the remote islands are connected to the Epi-Jomon (or Zoku-Jomon) culture. Epi-Jomon culture is often associated with the holdover of foraging practices in northern Japan and Hokkaido as opposed to communities in central and western Japan that transitioned to rice agriculture (Aikens and Higuchi 1982). For reasons currently unknown, Epi-Jomon populations in the Kuril Islands experienced a gradual decline between 2000 and 1600 cal BP and are difficult to recognize in the archaeological record after 1500 cal BP.

Immediately following (and perhaps overlapping) the Epi-Jomon cultural tradition in the remote Kuril Islands is the presence of artifacts associated with the Okhotsk culture. In Hokkaido, the Okhotsk culture flourished under a time of significant social and economic change throughout East Asia from 1500 to 800 cal BP (Hudson 2004, p. 293). The development of Okhotsk culture is thought to have occurred in three distinctive stages (Amano 1979 in Hudson 2004, p. 294). The first stage involves an eastern expansion from south Sakhalin Island into the Japanese archipelago including Rishiri, Rebun and northern Hokkaido. This is followed by a second stage of movement to the northeastern corner of Hokkaido and into the Kuril archipelago (Hudson 2004). In later stages of the Okhotsk period, populations inhabiting northeastern Hokkaido and the southern Kurils are believed to have been assimilated by proto-Ainu populations associated with the Satsumon culture (Deryugin 2008). By 700 cal BP, artifacts associated with Okhotsk populations in the remote Kuril Islands are no longer identifiable, suggesting a fairly rapid abandonment of the region.

The third major occupation of the remote Kuril Islands is associated with the Ainu culture. Ethnographically, the Kuril Ainu lived throughout the island chain in relatively large pit house villages as well as smaller seasonal camps (Kono and Fitzhugh 1999; Fitzhugh et al. 2002). Kikuchi (1999) suggests that the Ainu movement from Hokkaido into the remote Kuril Islands would have likely taken place during the fourteenth or fifteenth centuries AD (600–500 cal BP), following abandonment by the Okhotsk culture. Based on his interactions with the Kuril Ainu, Captain Snow (1897, p. 18–19) describes strong differences between the Ainu inhabitants of the remote Kuril Islands and their relatives in the southern islands and Hokkaido. As he states, “they had few things in common with their brethren of the south . . . the food of these people consisted of the flesh of seal, sea-lion, sea-otter, sea-fowl and their eggs, berries, a few roots and fish. They did not however, appear to be large eaters of the last named.”

During the early eighteenth and nineteenth centuries the Russian-American Company settled regions of the remote Kuril Islands with transplanted Alaskan and Siberian sea mammal hunters (Shubin 1994). The Japanese occupation of the Kuril archipelago during the twentieth century displaced many Ainu populations and World War II saw the fortification of the islands by the Russian military.

5.3 POTTERY PRODUCTION IN THE REMOTE KURIL ISLANDS

Coastal arctic and sub-arctic climates provide numerous challenges to pottery production, as winter seasons are long and cold, and summers are wet, windy and cool (Zhushchikhovskaya 2005; Frink and Harry 2008; Harry and Frink 2009; Harry et al. 2009). These conditions make it particularly difficult to form, dry and fire ceramics during the summer season and nearly impossible during all other seasons. Due to the interaction of the cold Oyashio current and the warm Soya current, the climate of the Kuril archipelago is no exception. The summer season is extremely wet (Razzhigaeva et al. 2009) and it is statistically one of the foggiest places on earth, with nearly 215 fog occurrence days per year (Tokinaga and Xie 2009). In addition, many of the remote Kuril Islands are characterized as tundra, with limited wood resources in the form of brush alder (*Duschekia fruticosa*) and dwarf pine (*Pinus pumila*), although driftwood can be periodically found on some islands.

While the remote Kuril Islands do not offer a favorable environment for pottery production, the reality of the archaeological record is that pottery remains are spatially and temporally ubiquitous. This work explores this paradox by examining a range of ceramic traits related to the production and use of pottery in this region. Based on cross-cultural research on the adoption of pottery by arctic and sub-arctic populations (Harry and Frink 2009), it is the initial assumption that pottery vessels in the remote Kuril Islands were primarily produced as cooking vessels that would be used in the boiling or stewing of meat, particularly sea-mammal. This assumption differs slightly from the expectation that hunter-gatherers may have initially developed pottery for use in ritual or prestige contexts (Hayden 1995). It is important to note that the division between the production of ceramic vessels for cooking and the production of ceramic vessels for ritual or prestige activities is a simplistic assumption, as pottery is commonly used in both social contexts. However, given the limited analysis of pottery from the remote Kuril Islands, this dichotomy is convenient for the initial assessment of ceramic production and use.

Building from the expectation that pottery in the remote Kuril Islands is tied to cooking activities, it is expected that a majority of pottery sherds from this region should display “coarse-ware” attributes. This includes plain or no decorations, simple design forms and little uniformity in the abundance, sorting and coarseness of temper found in ceramic pastes (Rice 1981: 220). Alternatively, the production of pottery for ritual or prestige contexts is expected to demonstrate features of “fine-wares” including intricate geometric decorations, diverse vessel forms and consistency in manufacturing techniques (Zhushchikhovskaya 2009), such as the size and proportion of temper.

TABLE 5.1. *Expectations for pottery vessel traits that are produced in association with either cooking or prestige activities.*

	Cooking (Coarse)	Prestige (Fine)
Decoration	Plain	Intricate/Geometric
Form	Simple	Complex
Temper (Abundance)	Variable	Consistent
Temper (Sorting)	Poorly Sorted	Well-Sorted
Temper (Coarseness)	Coarse	Fine

5.3.1 Collecting and Sampling the Kuril Pottery Assemblage

Pottery sherds analyzed in this research were recovered through survey and excavation performed by the Kuril Biocomplexity Project (KBP) from 2006 to 2008. The sampling of pottery sherds recovered by KBP used a multistage strategy combining non-random judgment sampling and random sampling. The sampling process proceeded by separating sherds within each site assemblage that contained distinctive features, such as recognizable decorative motifs (cord-marking, applique, incisions, geometric patterns or stamping). After isolating distinctive sherds, all rim or base sherds not yet included in the sample were selected for analysis. Finally, non-distinctive (undecorated) medium to large body sherds (those greater than 20 mm in any one dimension) from each site were randomly sampled until at least one-quarter of the total site assemblage was analyzed. Five out of twenty-five archaeological sites did not have at least 25 percent of their assemblage analyzed due to either very large assemblages (>750 sherds) and/or a large proportion of very small (<5 mm) fragments. In total, 1,114 sherds were analyzed from archaeological sites located in the island chain, with 419 sherds analyzed from sites in the remote Kuril Islands.

Analysis of the pottery assemblage involved the measurement and description of all sampled sherds. Descriptive information included weight, wall thickness, length, width, interior curvature, vessel part (body, rim, base) and surface treatment. For sherds identified as rims, additional descriptions included rim thickness, rim dimensions, rim symmetry and lip type. For sherds identified as bases, additional measurements included base thickness, base angle and base diameter. For sherds with decorative motifs, additional descriptions included the location of the design (interior/exterior), the style of decoration (cord-marking, incisions, applique, etc.), dimensions of the motif and a written description and/or photograph of the decorative elements. The measurement data collected in this research is archived with The Digital Archaeological Record (tDAR) and freely accessible at <https://core.tdar.org/dataset/393044>.

5.3.2 Decorative Features

The evaluation of pottery vessel decoration was accomplished through the development of a paradigmatic classification scheme that summarized the presence and absence of decorative features. In contrast to taxonomic classification, a paradigmatic classification uses an unordered and unweighted structure of predetermined characters (attributes) and their states to construct artifact classes (Dunnell 1971; O'Brien and Lyman 2003). The main advantage of a paradigmatic classification scheme in analyzing pottery decorations is that multiple character states can be combined in order to provide an unambiguous assignment of pottery sherds with no sherds remaining unassigned. Predetermined attributes used in this research were based on decorative features from published literature (Ohyi 1975; Tezuka and Fitzhugh 2004; Deryugin 2008) and included cord-marking, applique, incisions, punctuation, scratching and rim projections. In total, fifty-eight unique decorative types were identified in the assemblage with four examples highlighted in Figure 5.3.

Based on the paradigmatic classification scheme, decorated pottery sherds accounted for 38.6 percent of analyzed sherds from the remote Kuril Islands.

Cord-Marking

1. Absent
2. Aligned - large knots
3. Aligned - small knots
4. Aligned - braided
5. Geometric

Applique

1. Absent
2. Elevated - Doughnut
3. Elevated - Pellet
4. Elevated - Linear
5. Flat

Incisions

1. Absent
2. Thick - Geometric
3. Thick - Linear
4. Thin - Geometric
5. Thin - Linear

Punctuation

1. Absent
2. Circular
3. Stamped

Scratching

1. Absent
2. Present

Rim Projections

1. Absent
2. Large
3. Small



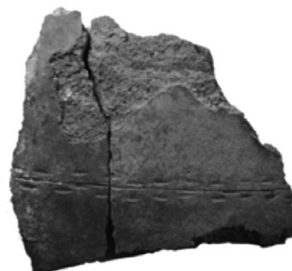
Rasshua 1
FS#3990; SM#8077-641
PCC: 321113



Sernovodskoe 1
FS#99; SM#7861-8
PCC: 341111



Berezovka 1
FS#47; SM#7867-167
PCC: 112111



Kharimkotan 1
FS#776
PCC: 115111

5.3. Paradigmatic classification scheme for decorative features with examples of common decorations including the field sample number (FS#), Sakhalin Museum accession number (SM#) and paradigmatic classification code (PCC). Photos of ceramic sherds taken by E. Gjesfjeld

TABLE 5.2. *Summary statistics and diversity indices for the southern and remote regions of the Kuril archipelago.*

Region	Sample Size	Percent Decorated	Number of Paradigmatic Types	Shannon Diversity Index	Diversity Interpretation
South	678	49.4%	53	2.00	Moderate
Remote	419	38.6%	23	1.13	Low

Cord-marking represents the most common decoration with 76.7 percent of decorated sherds displaying this design element. The high proportion of cord-marking decoration is not surprising given that initial occupation of the region occurred during the Epi-Jomon cultural period. Similar to earlier Jomon pottery, cord-marking is a distinctive characteristic associated with Epi-Jomon pottery and is identifiable throughout the Kuril archipelago, Hokkaido and Sakhalin. The furthest geographical extent of cord-marked pottery was on the island of Shiashkotan at the site of Drobyne I.

Differences in decorative styles are most noticeable when comparing pottery recovered from the remote Kurils with pottery recovered from the southern Kuril Islands. The most prominent difference is the presence of elaborate geometric designs and rim projections on Epi-Jomon pottery from sites in the southern region as opposed to only simple cord-marked decoration found on pottery from sites in the remote islands. The absence of more intricate geometric patterns is recognized in the decorative diversity index for each region (Table 5.2). Using a Shannon Diversity Index (Shannon and Weaver 1948) to estimate decoration diversity (similar to Nelson et al. 2011), pottery from the southern regions not only has a higher number of paradigmatic types than the remote region but also higher diversity. These results suggest that even when considering the smaller sample size, the variety of decorative features is lower in the remote islands than the southern islands.

Perhaps the most intriguing feature of pottery decoration from the remote islands is the near complete absence of diagnostic features associated with the Late Epi-Jomon period (2000–1300 cal BP) or the early Okhotsk period (1300–1000 cal BP), with the exception of a single Kohoku C2-D fragment found on the island of Chirpoi. The absence of Kohoku type pottery is important for not only inferring the extent of Late Epi-Jomon occupation but also because Kohoku pottery often demonstrates “fine-ware” characteristics such as elaborate geometric designs. The absence of Kohoku-style pottery in the remote Kuril Islands suggests that the production and use of “fine-ware” pottery was solely confined to the southern region.

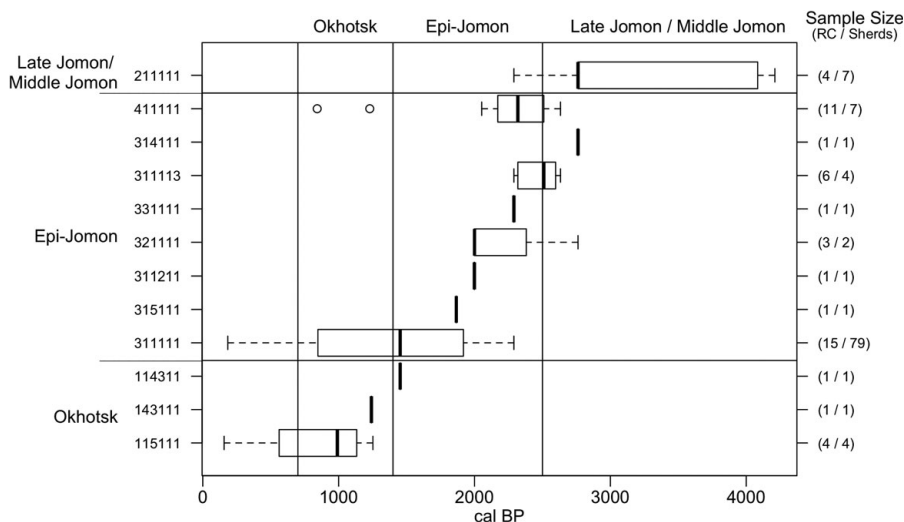
The analysis of decorative features also provided the opportunity to compare the current pottery typology of the remote Kuril Islands to the cultural chronology of

the region as inferred from radiocarbon dates. Out of the fifty-eight unique pottery types identified through paradigmatic classification, forty types can be considered diagnostic to one of three culture-historical periods: Middle/Late Jomon (4500–2500 cal BP), Epi-Jomon (2500–1400 cal BP) and Okhotsk (1400–700 cal BP). Out of the forty diagnostic types, twelve types (110 total sherds) can be chronologically affiliated with at least one radiocarbon date from the same excavation level. The remaining twenty-eight diagnostic types were either recovered from surface contexts or excavation levels without an associated radiocarbon date.

As highlighted in Figure 5.4, the chronological expectations of pottery types generally conform to expected age ranges. With the exception of type number 314111, all diagnostic types culturally affiliated with the Epi-Jomon have mean ages within the expected culture-historical boundaries of the Epi-Jomon. While fewer radiocarbon (RC) and pottery samples (Sherds) are available for Okhotsk pottery types, radiocarbon dates also generally coincide with expected culture-historical ages. Of particular interest is the chronological association of pottery type number 115111 (thin linear incisions) with the Middle and Late Okhotsk culture-historical period. If accurate, these pottery sherds represent one of the first pottery types in the remote Kuril assemblage to be associated with a specifically northern Hokkaido pottery style (Chinsemon).

5.3.3 Vessel Shape

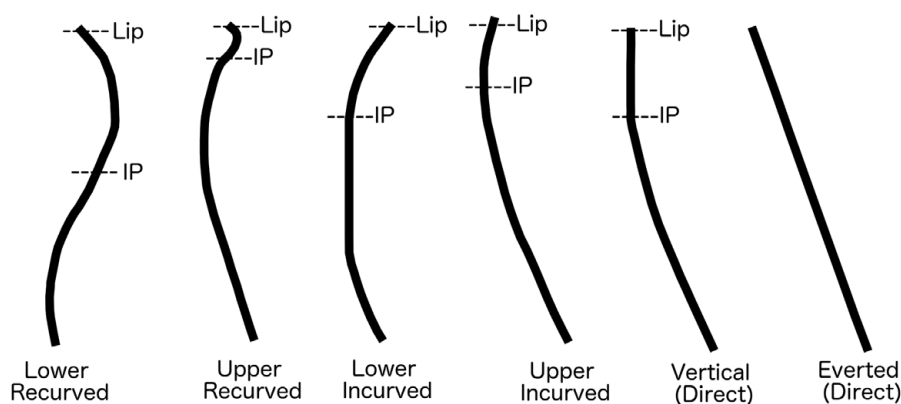
Vessel shape was evaluated through the analysis of three components considered to be informative about the construction and function of a vessel; these



5.4. Boxplots of calibrated radiocarbon dates (weighted mean) with diagnostic pottery types and their associated cultural period (y-axis), as well as chronological periods with their associated cultural periods (x-axis).

include the shape of the body/neck, orifice size and base shape (Rice 1987; Cochrane and Neff 2006). Using a classification scheme based on points of curvature, the body/neck shape is defined as the shape of the vessel from just below the rim end point (lip) extending down to the first inflection point above the maximum diameter of the vessel (Rice 1987). Based on this scheme, six different body/neck shapes were identified within the remote Kuril Islands pottery assemblage. These include lower recurved, upper recurved, lower incurved, upper incurved, vertical and everted (see Figure 5.5). Given the difficulty in distinguishing between vertical and everted rim sherds without full vessels, these shapes were combined into a more generic neck shape referred to as “direct.” Analysis of neck shapes indicates two primary body/neck shapes in the assemblage, direct (31.9 percent) and lower recurved (30.2 percent). Both of these body/neck shapes are associated with the practice of cooking, as this shape allows for the greatest access to vessel contents, as opposed to restricted vessel shapes that are more characteristic of storage vessels (Rice 1987). The high proportion of vessels with a substantial neck or collar region, classified as a lower recurved body, is not surprising as this vessel shape is a diagnostic feature of Okhotsk-style ceramics (Deryugin 2008). The likely function of the large neck or collar region is to create a lower vessel shoulder (or inflection point), which enhances the balance and “graspability” of the vessel (Rice 1987).

Reconstructing vessel size from pottery sherds relies heavily on the use of rim sherds to determine orifice diameter, which in turn is used to estimate overall vessel size. Based on comparison of vessel sizes from nearby regions including Hokkaido and Sakhalin, small vessels are considered to have an orifice diameter of less than 15 cm, medium vessels between 15 and 30 cm and large vessels greater than 30 cm. In the remote islands, medium vessels are the most common, accounting for 43 percent of all sizes, with small vessels accounting for 37 percent and large vessels making up 20 percent of the assemblage.



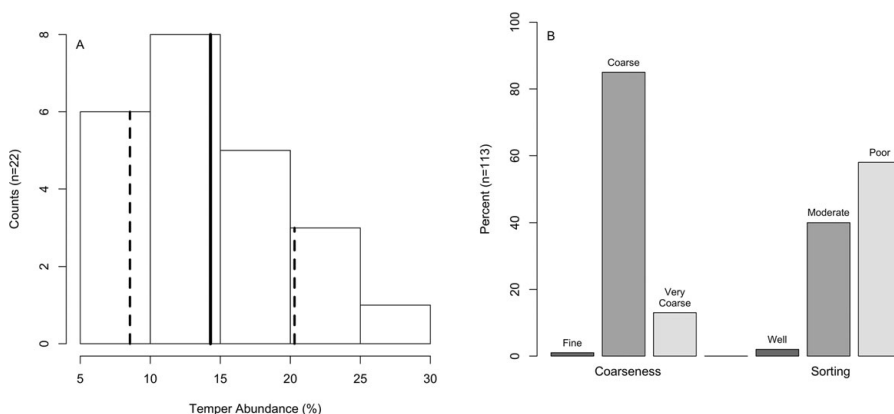
5.5. Range of body/neck shapes identified in the Kuril pottery assemblage. (IP refers to the first inflection point)

Base sherds are often less informative than rim sherds on reconstructing vessel size although neither provides direct information concerning vessel height. From an analytical perspective, base sherds can only provide a very general classification between tall or short vessel forms with a wide base angle and large diameter suggesting flatter and shorter forms. Base sherds with a higher angle (closer to 90°) and smaller base diameter suggest taller and more cylindrical forms. In the Kuril pottery assemblage, few basal fragments were recovered with base sherds totaling only 9.8 percent. Of these basal sherds, all base types were flat with an average diameter of 9.7 cm, and an average base angle of 108° . These dimensions suggest that most vessel forms were tall, cylindrical bowls of medium size.

5.3.4 Paste Composition

In the manufacture of pottery throughout the world, a wide diversity of material is often utilized for temper, including organic and inorganic materials. Previous analysis of ceramics from around the Sea of Okhotsk demonstrate that a majority of vessels are tempered with inorganic mineral temper (Kidder 1976; Hall 2004; Tezuka and Fitzhugh 2004; Zhushchikhovskaya and Shubina 2006; Deryugin 2008). Exceptions to this include the use of organic temper (fiber temper) among early pottery traditions of the Initial, Early and Middle Jomon periods, and the use of shell temper among the Imchin culture of northern Sakhalin (Zhushchikhovskaya and Shubina 2006). In the remote Kuril pottery assemblage, the sole temper type is mineral-based, either crushed rock or sand. This is visually recognized in both the macroscopic and microscopic cross-sections of pottery sherds.

The abundance, coarseness and sorting of non-plastic inclusions (temper) was examined through the analysis of petrographic thin sections and



5.6. Histogram of temper abundances (A) showing mean (solid line) and spread (dashed lines), as well as distribution of temper coarseness and sorting classes (B).

non-impregnated polished sections. It is assumed here that a high degree of coarseness (large grains) and a poorly sorted matrix (many different sizes of mineral temper) imply a less uniform manufacturing process (Rice 1981). The higher prevalence of moderate to low temper abundances (Figure 5.6A) suggests the use of mineral temper to reduce thermal stress and cracking during firing and cooking activities. The average proportion of temper in clay pastes (14.8 percent) is generally low enough to enhance stability during firing but not high enough to cause major changes to the density and porosity of the clay paste (Rye 1981). Examination of temper coarseness and sorting indicate a high proportion of coarse grains that are poorly sorted (Figure 5.6B). In other words, the predominant paste composition is characterized by many different sized grains with large mineral grains being the most abundant. These results suggest that paste recipes were not standardized and that a wide diversity of clay paste recipes were used among potters of the remote Kuril Islands.

The analysis of pottery decoration, form and paste suggests most pottery vessels from the remote Kuril Islands were used as cooking vessels. This conclusion is based on the low diversity of decorative features, the high proportion of unrestricted tall bowls of medium size and the lack of uniformity in paste composition. Based on the assumed relationship between “fine-ware” and ritual or prestige activities, there is little to no evidence for the production of “fine-ware” pottery in the remote Kuril Islands. However, it should be noted that at archaeological sites located in the southern region, a small number of sherds do demonstrate decorative features that are suggestive of “fine-ware” production.

5.4 INVESTIGATING POTTERY FUNCTION IN THE REMOTE KURIL ISLANDS

The starting expectation of this research is that pottery was produced in the remote Kuril Islands for the cooking of meat, specifically sea mammal. However, our understanding of how remote Kuril populations were using these cooking vessels and what they were cooking still remains poorly understood. In order to explore these questions, this research examined differences in cooking strategies through the analysis of vessel thickness, as well as a pilot analysis of organic residues that identified resources that were cooked in pottery vessels, and the general range of temperatures at which these resources were cooked.

5.4.1 *Cooking Strategies*

One of the most significant factors influencing the cooking performance of ceramic vessels is the thickness of vessel walls and bases. In cooking practices

that use direct heating methods, thin walls are more advantageous as they tend to be more resistant to thermal shock and conduct heat, allowing food to cook faster and saving fuel (Henrickson and McDonald 1983; Harry and Frink 2009). In contrast, thick walled vessels can be advantageous when used with hot-stone cooking methods, as the thick walls reduce the loss of heat by providing greater insulation (Reid 1989). The use of either direct heating or hot-stone cooking methods by remote Kuril populations is evaluated here by examining differences in the thickness of ceramic vessel walls and bases. Drawing from research in Alaska, the choice of groups to use either direct or indirect (hot-stone) heating methods is influenced by raw-material availability. Populations living in tundra conditions with limited access to fuel tend to prefer direct heating methods and interior populations with greater access to wood prefer indirect heating methods (Harry and Frink 2009). Therefore, it is the initial expectation of this research that populations inhabiting the tundra environment of the remote Kuril Islands would favor direct heating methods and thin-walled (4–8 mm) pottery, as using wood to indirectly heat stones is less efficient than directly heating ceramic vessels (Harry and Frink 2009).

Thickness measurements of pottery walls and bases were determined by averaging digital caliper measurements from two different locations on body and base sherds. In total, 303 sherds from six different archaeological sites were examined. The average thickness of vessel walls from these sites is 8.7 mm and the average thickness of vessel bases is 9.7 mm. In comparison with pottery recovered from the southern region, no significant statistical differences ($p < 0.01$) could be identified in thickness measurements (see Table 5.3A). However, based upon previous research from around the Sea of Okhotsk (Zhushchikhovskaya and Shubina 2006), differences in vessel thickness are known to be highly correlated with different cultural traditions. Using

TABLE 5.3. Average wall and base thickness measurements for the southern and remote regions of the Kuril Islands (A) and the average wall and base thickness for Epi-Jomon and Okhotsk sherds from the remote Kuril Islands (B). (*) indicates strongly significant differences ($p < 0.01$) as determined by the Welch's two-sample t-test for populations of different sizes and variances.

A) Regions	Wall Thickness (mm)			Base Thickness (mm)		
	n	Mean	S.D.	n	Mean	S.D.
South	585	8.5	2.0	52	7.9	1.7
Remote	303	8.7	1.9	33	9.7	4.7

B) Remote Islands by Culture	Wall Thickness (mm)			Base Thickness (mm)		
	n	Mean	S.D.	n	Mean	S.D.
Epi-Jomon	136	7.8*	1.1	12	7.4*	1.2
Okhotsk	167	9.4*	2.0	21	11.1*	5.5

diagnostic traits, pottery sherds from the remote islands were assigned a cultural affiliation, with cord-marking indicating Epi-Jomon affiliation and either linear incision, stamping or lower recurved body form indicating Okhotsk affiliation. As highlighted in Table 5.3B, statistical tests indicate that significant differences ($\star = p < 0.01$) do occur in thickness measurements between these two cultural traditions.

The identification of statistically significant differences in vessel thickness between Epi-Jomon and Okhotsk pottery provides preliminary evidence for cultural rather than regional differences in cooking strategies. For example, Reid (1989, p. 173) suggests that vessels used in conjunction with hot-stone boiling methods should display “an over-thickened, flat, stable base” and thicker walls that can act as an insulator to absorb the radiant and impact energy of hot stones. In contrast, the thinner walls and bases of Epi-Jomon pottery are more useful in the direct transfer of heat from an external fire. Given that hot-stone boiling methods are less efficient and use higher amounts of fuel (Harry and Frink 2009), why would Okhotsk populations living in the remote Kuril Islands possibly use indirect heating methods? One advantage of hot-stone boiling is greater control of cooking temperature over longer periods of time. Based upon ethnographic evidence from northwestern North American foragers (Reid 1989), hot-stone boiling methods were often used when a long simmer (85–88° C), rather than a boil, was desired. Drawing on modern industrial rendering methods, low temperature heating (~60° C) was typically used in the more delicate extraction of oils from liver or blubber (Shahidi et al. 1994) rather than the higher temperatures associated with extraction from bone marrow (Church and Lyman 2003).

5.4.2 Exploratory Lipid Residue Analysis

Building from the analysis of vessel thickness, a pilot study was conducted to identify what type of resources were used in association with pottery. If ceramics were routinely used by remote Kuril populations in cooking practices that utilized high and direct heat, it is expected that lipid residues extracted from pottery sherds would demonstrate marine lipid signatures *and* marine biomarkers that are produced by the repeated heating of fatty acids to high temperatures (Reid 1989; Copley et al. 2004; Hansel et al. 2004; Evershed et al. 2008; Heron et al. 2010; Craig et al. 2011). If pottery was used in low-heat practices, such as the rendering of marine oils, it is expected that organic residues would display marine lipid signatures but lack marine biomarkers, which are formed during repeated heating to higher temperatures.

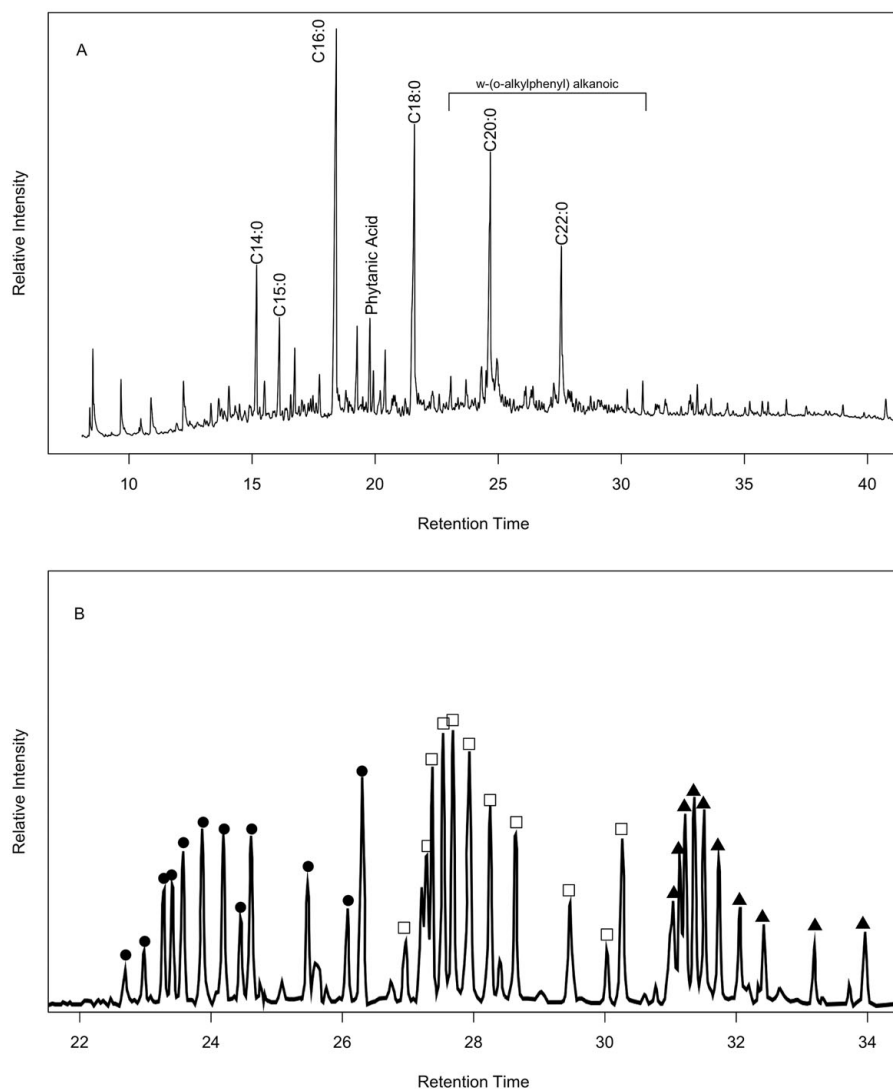
Organic residues associated with marine fats/oils have traditionally been difficult to identify due to the rapid degradation of unsaturated fatty acids

during pottery vessel use and burial (Evershed et al. 2008). However, research (Copley et al. 2004; Hansel et al. 2004; Evershed et al. 2008; Heron et al. 2010; Craig et al. 2011) has demonstrated two fatty acids that provide evidence of marine fats/oils. These are two isoprenoid acids: phytanic acid (3,7,11,15-tetramethylhexadecanoic acid) and 4,8,12-TMTD (4,8,12-trimethyltridecanoic acid). In addition to these biomarkers, experimental work has also demonstrated that ω -(*o*-alkaphenyl)alkanoic acids are produced through the prolonged heating of unsaturated marine fatty acids at 270° C or above (Evershed et al. 2008; Heron et al., 2010). By evaluating the presence of both isoprenoid marine biomarkers (phytanic acid and 4,8,12 TMTD) and alkanolic acids, this research tests for the use of ceramic vessels in the cooking of aquatic resources, as well as the relative temperature (above or below 270° C) of cooking.

Lipid residue analysis of extracted fatty acids was performed in the Sachs Lab at the University of Washington on fifteen ceramic sherds from four archaeological sites in the Kuril Islands (Ainu Creek (south), Vodopodnaya (remote), Rasshua (remote) and Ainu Bay (remote)). Lipid analysis was performed following established laboratory protocols (Evershed et al. 1990, 1994) by pulverizing pottery sherds and extracting lipids by accelerated solvent extraction (ASE) in a dichloromethane/methanol (DCM) solvent. The solvent extract was evaporated under N₂ to obtain a total lipid extraction (TLE). The total lipid extract was silylated and analyzed by gas chromatography-mass spectrometry (GC-MS). Identification of lipid biomarkers was accomplished through the analysis of ion chromatograms, with the identification of each biomarker based on their specific mass to charge ratio (*m/z*) using their trimethylester (TME) derivative.

Results of lipid residue analysis demonstrate that all pots examined contained marine lipid signatures, but only pots from the southern site of Ainu Creek had a high proportion of Epi-Jomon and Okhotsk samples (five of eight; 63 percent) that contain ω -(*o*-alkaphenyl)alkanoic acids, which are produced from repeated heating of marine fats to 270° C. In contrast, pottery remains from the remote Kuril Islands, where all sherds are associated with the Okhotsk culture, demonstrate a significantly lower proportion of sherds (two of seven; 29 percent) that show alkanolic acids (see Gjesfjeld 2014 for additional details).

One explanation for the reduced proportion of Okhotsk samples with ω -(*o*-alkaphenyl) alkanolic acids is the use of low-heat cooking strategies for the rendering of marine oils from fish or marine mammals. In other populations from the North Pacific, the production of marine oil from whale, seal, sea lion or fish fat is common. As ethnographic evidence from Kodiak Island, Alaska highlights, oil was an important commodity in the winter storage of edible roots, stems, berries and leaves that were collected during the summer months



5.7. Partial gas chromatogram of lipid residues from an Okhotsk body sherd vessel (FS# 2283–5) from site of Ainu Creek on Urup. (A) Ion chromatogram with major fatty acids identified as well as phytanic acid and the region of interest for ω -(o-alkylphenyl) alkanolic acids. (B) A m/z mass chromatogram showing the range of alkanolic acids present including ω -C18s (filled circles), ω -C20s (open rectangles) and ω -C22s (filled triangles).

(Holmberg 1985: 41–42). Early explorer Davydov (1976: 16) goes so far as to remark, “without [oil] they could barely exist and would never be happy.” As suggested by Fitzhugh (2003: 69), drawing from Speth and Spielman (1983), the importance of oil within communities around Kodiak Island may be a biological response to supplement the nutritional deficiencies of a lean-meat, high-protein (fish) diet with marine fats that are vital to surviving late winter and early spring resource depressions. It is proposed here that a similar

process might be happening in the remote Kuril Islands, as the neighboring populations of northern Hokkaido (and potentially Kamchatka) are known to have relied heavily on fishing to survive the winter months (Hudson 2004). The production and exchange of marine oil by Okhotsk populations living in the remote Kuril Islands could have been an important and valuable commodity to trade with populations in these neighboring regions.

5.5 CONCLUSIONS

The research presented in this chapter started with a simple question: Why produce pottery in the isolated and challenging environment of the remote Kuril Islands? Through the descriptive analysis of vessel attributes and lipid residues, this research concludes that the production and use of ceramics in the remote Kuril Islands was tied to the cooking of marine resources, with Okhotsk populations using ceramics to specialize in the production of marine oils. It is important to note that even though the exchange of marine oil is difficult to recognize archaeologically, previous compositional analysis of pottery (Gjesfjeld 2018) and obsidian (Phillips and Speakman 2009) demonstrate that Okhotsk populations living in the remote Kuril Islands had broader and more dense exchange networks as compared to Epi-Jomon populations. In particular, obsidian sourcing demonstrates the extensive procurement and use of Kamchatka obsidian (Phillips 2011) by Okhotsk populations inhabiting the remote islands.

Overall, the pottery assemblage of the remote Kuril Islands presents an intriguing example of pottery production and use by maritime hunter-gatherers living in an isolated and sub-arctic landscape. Despite strong social and environmental constraints, pottery was consistently produced, used and repaired for nearly three millennia. An unexpected outcome of this research is that the motivation behind producing and using pottery in the remote islands likely differed between the Epi-Jomon and Okhotsk occupations. Arguably, the Epi-Jomon produced and used pottery for the traditional cooking of aquatic resources, similar to their Jomon ancestors and Hokkaido relatives. Okhotsk pottery production, on the other hand, reflects a more specialized focus on the production of marine oil, similar to maritime hunter-gatherers from around the North Pacific.

Given that the rapid abandonment of the remote Kuril Islands by Okhotsk populations is not tied to either major catastrophic events (Fitzhugh 2012) or climatic changes (Fitzhugh et al. 2016), future research in the remote Kuril Islands needs to strongly consider the economic motivations for the migration and abandonment of Okhotsk populations in this region. If, as suggested in this chapter, Okhotsk populations inhabited the remote Kuril Islands to produce and exchange marine oil, their long-term occupation of the region is strongly tied to the demand for marine oil in the southern Kuril Islands, Kamchatka and

Hokkaido. If this broader regional demand for marine oil was compromised, either through shifting exchange networks, warfare, political instability or simply changes in preferences, abandonment of the remote Kuril Islands should not be unexpected. Perhaps the most important contribution of this research is to highlight that the remote Kuril Islands are influenced by the larger regional system of Northeast Asia. Based on similarities in pottery technology and the possible exchange of marine oil, it is clear that the maritime hunter-gatherers of the Kuril Islands were not living in isolation but directly and indirectly participating in the economic, technological and political dynamics of the surrounding regions. By understanding how the remote Kuril Islands fit within the broader complexities of Northeast Asia, future research can refine and enhance our understanding of this unique region.

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UNDERSTANDING THE FUNCTION OF CONTAINER TECHNOLOGIES IN PREHISTORIC SOUTHWEST ALASKA

Marjolein Admiraal and Rick Knecht

INTRODUCTION

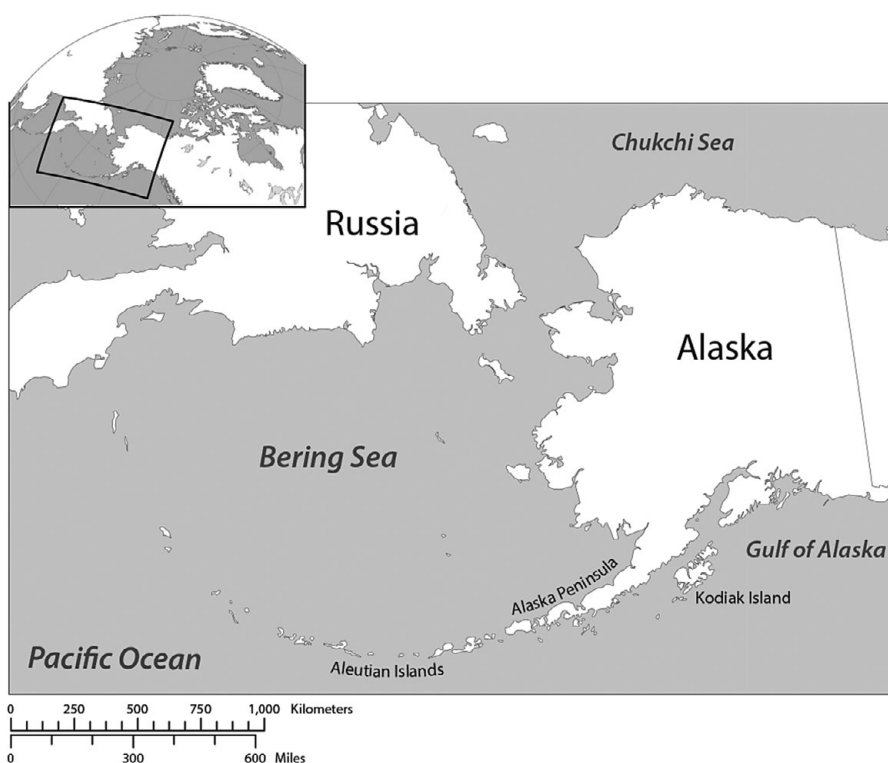
Where the Pacific Ocean meets the Bering Sea, sharp green peaks rise from the water surrounded by low hanging clouds. These peaks are the Aleutian Islands, which form part of the Pacific Ring of Fire, a circum-Pacific chain of volcanoes. Humans have inhabited the Eastern Aleutian Islands for at least 9,000 years. It was on one of these islands that the earliest evidence for the use of container technologies in Alaska was discovered: a stone bowl fragment dating to at least 8000 BP¹ (Aigner 1977).

Since these early times, container technologies such as stone bowls and pottery have played a significant role in people's everyday lives. Vessels are often associated with household activities such as cooking and storing. But the cost of maintaining container technologies in challenging environments, such as in the Arctic and Subarctic, is high. Nevertheless, prehistoric peoples in Southwest Alaska chose to invest great time and effort in the manufacture of stone bowls and ceramic vessels. However, not much is known about the function of these potentially very important containers. What was so important about these container technologies that people were willing to invest in them so extensively? What were they used for? What motivated people to use expensive vessels and how was this use embedded in their everyday lives?

The process of converting marine resources into food and fuel may be a vital consideration when trying to understand the role container technologies played

in the lives of Alaska's prehistoric coastal communities. The introduction of these container technologies coincides with the intensification of a more sedentary maritime subsistence strategy. Additionally, the distribution of stone bowls and pottery in Alaska appears to be limited to coastal areas. In contrast, inland groups generally lack expensive container technologies, although there are some exceptions. Vessel function plays a significant role as it may explain why container technologies were so important in maritime economies. Despite this, vessel function has rarely been investigated and remains poorly understood. It is hypothesized here that the introduction of container technologies is connected to the rise of a specialized maritime adaptation.

This chapter aims to critically review the current knowledge of container technologies in Southwest Alaska in order to gain an understanding of vessel function and the role container technologies played in prehistoric societies in Southwest Alaska. The focus area encompasses the Southwest Alaskan coast of the Pacific Ocean and the Bering Sea, including the Yukon-Kuskokwim River Delta, the Alaska Peninsula, Nunivak Island, the Aleutian Islands and the Kodiak Archipelago (Figure 6.1). The chapter is organized chronologically (Table 6.1), starting with the stone bowls of the Aleutian Islands and the technology of griddle stones that eventually replaced stone bowls in that area. Subsequently the



6.1. Map of Alaska, including the Alaska Peninsula, Aleutian Islands and Kodiak Island.

first emergence of pottery in Alaska is discussed, after which more attention will be given to the establishment of the pottery-using Norton and Thule cultural traditions in Southwest Alaska. Questions concerning the replacement of Norton pottery by Thule pottery and the wide influence Thule culture had on, for example, the Koniag tradition of the Kodiak Archipelago, will be addressed. What technological choices were made and why? Tools were used at every stage of food procurement and processing, and every step (i.e., capture, processing, cooking, consuming, storing) in this process demanded a specific tool kit. How did container technologies fit into these processes? What was their function?

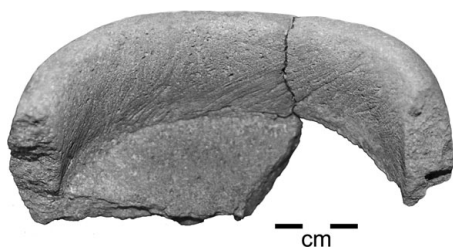
THE RISE OF ALASKAN CONTAINER TECHNOLOGIES

The earliest evidence of container technologies in North America is found in a site from the Anangula Culture on the Eastern Aleutian Islands, dating to around 8000 BP in the form of a bowl fragment carved from volcanic stone (Aigner 1977; McCartney and Veltre 1996). The manufacture of stone bowls is, like many other crafts, labor-intensive and time demanding. What was so important about these vessels that they were worth such an effort? Very little research has been conducted on this vessel type. Pottery has been better studied. The use of pottery is generally confined to warmer, dry climates where clay can be dried and fuel is abundant for firing. In the Subarctic, winters are often too cold for the procurement of clay. During the short summer season circumstances are more favorable, but still far from ideal. Because of damp conditions in the coastal areas where pottery is usually found, clay pots dry slowly and, due to fuel shortages, firing is often problematic. The manufacture of pottery in the Subarctic is a time-consuming process. Despite these challenges, humans produced simple ceramic pots across Alaska from at least 2600 BP to late historic times (Harry et al. 2009; Anderson et al. 2017).

Stone Bowls from the Aleutian Islands

Stone bowls have a long-lived presence on the Aleutian Islands and generally date to a phase described by Knecht and Davis (2001) as the Margaret Bay phase: 4000–3000 BP. Among others, sites containing bowls from this period are the Unalaska Island sites at Margaret Bay (UNL-48, $n = 426$), Amaknak Bridge (UNL-50, $n = 71$), Tanaxtaxak (UNL-55, $n = 6$) and the Chaluka site located on Umnak Island. An earlier, though scarce occurrence ($n = 1$) was recorded at the Anangula Blade site, dating to the Early Anangula phase: 9000–7000 BP (Aigner 1977). In the past, stone bowls have been incorrectly interpreted as pottery (Quimby 1945). This notion was later rectified by McCartney (1970); there is no known occurrence of pottery on the Aleutian Islands.

Most of the stone bowls are large and either oval or sub-rectangular in form (Figure 6.2 and 6.3). Sizes generally range from 12 to 45 cm in diameter and 3 to



6.2. Nicely ground stone bowl fragment of fine-grained volcanic tuff from the Amaknak Bridge site (UNL50-#1383). (Photograph: M. Admiraal, courtesy of the Museum of the Aleutians)



6.3. Large stone bowl fragment made of coarse volcanic tuff from the Margaret Bay site (UNL48-#1479). (Photograph: M. Admiraal, courtesy of the Museum of the Aleutians)



6.4. Aleutian stone lamp, notice the shallow basin and slightly raised platform in the middle for the wick. (Photograph: M. Admiraal, courtesy of the Museum of the Aleutians)

13 cm in depth (Denniston 1966, Knecht and Davis 2001, Knecht et al. 2001). Stone bowls are large and heavy to the point that they are not easily portable. Bases of the bowls are flat and thinner than the rims. Two different bowl shapes can be roughly distinguished. One type is nicely ground and shaped on both the inside and the outside and usually made of fine-grained tuff (Figure 6.2). The other type is made of a coarser volcanic tuff resulting in bowls with a rougher appearance. The latter are also bigger and generally have higher walls (Figure 6.3). Layers of charred material are often present on the exterior and rims of bowl fragments of either type, while the insides of the bowls are usually clean (Knecht and Davis 2001, Knecht and Davis 2008). The presence of a greasy layer of organic material on vessels is often assumed to be associated with the rendering of marine mammal fats (Knecht et al. 2001). Could this be the main function of these vessels? Future research on residues may provide an answer to this question.

The function of stone lamps is better understood. Rendered animal fat was burned in these extremely shallow vessels with thick bases that are easily distinguished from the thin based, steep sided stone bowls (see Figures 6.2 and 6.3 compared to Figure 6.4). The use of stone bowls in the Aleutian Islands sharply declined after 3000 BP until eventually being abandoned around 2000 BP (Knecht et al. 2001). The decline of the stone bowls may be connected to the increased occurrence of a rival cooking technology known as “griddle stones.”

Griddle Stones or “Stone Frying-Pans”

These flat stones have been described as “stone frying-pans” by Jochelson (1925, p. 73) and are also found in the Aleutian Islands. Even though this artifact type is not very similar to the stone bowls, they might have been used for the same purpose: cooking, and thus might have functionally replaced the stone bowls after 2000 BP. The stone slabs range in thickness from 1 to 4 cm. They were found at various sites on Unalaska and Amaknak Island, including the Tanaxtaxak and Oiled Blade sites as well as at various sites on Adak Island (ADK-061; -011; -012; -171) (Corbett et al. 2010; Hatfield 2010; Wilmerding and Hatfield 2012) and at the Islands of the Four Mountains (Virginia Hatfield, personal communication, 2017). At Adak Island it is evident that griddle stones became more common through time with the earliest specimens at 6041–5735 BP, then a clear increase and an absolute abundance of griddle stones during the period of 400–170 BP (Wilmerding and Hatfield 2012).

How were these flat stone slabs used? At the late historic Nunik site, midden material containing shellfish, marine mammal bones and fish remains were associated with griddle stones. These features have been interpreted as roasting pits by Johnson (2004). Jeanotte et al. (2012) conducted a study of lipid residues on griddle stones from the ADK-011 site. They conclude that organic residues on the surface of the griddle stones show contributions from sea food, probably as a result of prehistoric cooking practices. However, further bioarchaeological research is necessary to confirm this.

Ethnohistorical research can provide valuable information on methods of food preparation and processing. Various sources quoted in Johnson (2004) note that fish was commonly consumed raw, as was meat, often in order to maintain vitamins important for survival in the subarctic environment. However, Jochelson (1925) notes that fish was also sometimes prepared in nearby hot springs. He describes how cooking usually took place either in the open air or in semi-underground kitchen huts: “There they fried meat of sea animals, birds, and fishes on flat stone frying-pans called *cu’ñlux’*” (p. 73). He also stresses that lamps were not used to cook on as they were in the southern regions. The griddle stones are further defined by Jochelson (1925) as made “of volcanic andesitic tuff blackened by smoke on the lower side and with grease on the upper. In use the edges of the frying-pan were supported by stones, so wood could be burned under it” (p. 73). C. I. Shade described the traditional Unangan way to prepare soup using a griddle stone in Johnson (2004: 52):

The traditional method of making soup was to dig a fire pit and place over it a stone, flush with the ground. Then a very thin beach stone was placed on the fire stone and clay walls built upon this base. The liquid



6.5. Griddle stone fragment from the Tanaxtaxak site (UNL55-#2247). (Photograph: M. Admiraal, courtesy of the Museum of the Aleutians)

was cooked in this. A bluish clay called qudii u was used for the walls of this vessel which turned white when heated. This kind of fire pit was called unaalu. The same vessel was used more than once. One way of preparing the cod soup was with seaweed and seal oil.

Griddle stones may have been used in different ways. A specimen from the late prehistoric Tanaxtaxak site shows a use pattern that might be consistent with Shade's report (Figure 6.5). A clear line is visible on the (fractured) griddle stone, possibly marking the location of an object; this could have been a thin beach stone as mentioned by Shade. On the outside of the line, food crust residues are plenty, on the inside the surface is clean. This might also represent the boundary of the clay walls Shade speaks of, however no visual evidence of these walls was found on the flat stone, nor is there any mention of clay remains in the excavation report.

Early Pottery

Pottery first appears in the area of the Bering Strait around 3000 BP (Ackerman 1982). The Norton tradition, generally restricted to the coastal regions of Alaska, was the first culture in the North American Arctic to have used and

manufactured pottery. Norton, however, is not homogeneous throughout Alaska and the northern expression differs from the southwest mainly in subsistence patterns. These subsistence patterns may prove to have played a major role in the local adaptation of pottery. The southwest Norton tradition was mainly based on a mixed subsistence strategy of fishing (salmon), terrestrial hunting (caribou) and maritime hunting (seal). In 1977, Dumond defined the wider Norton tradition as including the Choris, classic Norton and Ipiutak traditions (Dumond 1977).

Choris

Choris (3800–2600 BP) is the first known archaeological tradition in Alaska to have made and used pottery and it is therefore an important point of departure. Choris may be described as the cultural gateway for ceramic container technology from Northeast Asia, where it is thought to have originated, to Arctic North America (Dumond 2000). Although caribou remained the dominant prey-species, the Choris era marked an initial shift in subsistence with an increased focus on marine resources (Ackerman 1998). Choris bears resemblance to the Arctic Small Tool tradition (ASTt) as well as to cultures on the Pacific coast of the Alaska Peninsula and eastern Siberia (Dumond 2000). As economic focus shifted, sedentariness increased and pottery was introduced. Pottery of this period is generally thin walled, fiber tempered and well fired. Early pottery is cord marked and has flat bottoms (Ackerman 1998). Later pottery has round or conical bases, which makes the pottery less susceptible to thermal shock, and it is usually decorated with linear designs. Check stamped designs are also known, however these designs are more common in the later Norton phase (Ackerman, 1998, Dumond 2000, Dixon 2014).

Norton

By 2500 BP, the Choris culture had been entirely subsumed by the Norton. Subsistence was still based on both coastal (e.g., seal and sometimes whale) and terrestrial resources (caribou). However, river fishing seems to have played a particularly significant role. There is an abundant presence of net sinkers at Norton sites south of the Bering Strait. Additionally, major sites are often located near river mouths along the Bering Sea coast or further upstream. Fishing practices were primarily focused on anadromous fish (e.g., salmon) (Dumond 2016). These fish spend most of their lives at sea but migrate to fresh water to spawn. These “runs” primarily occur south of the Bering Strait, which might explain why the Norton tradition was different in the south and remained there for another 1,000 years, while in the north it was replaced by the non-ceramic Ipiutak around 2000 BP (Dixon 2014).

As demonstrated by Britton et al. (2013), on Nunivak Island, Norton people maintained a predominantly high trophic marine diet around 1750 cal BP. As

caribou and salmon were also available this seems to have been the result of dietary choice and not dictated by environmental limitations. Additionally, the diet seems to have been consistent throughout the year, suggesting that people were able to maintain the same diet in a highly seasonal environment, probably through the storage of dried meat.

The occurrence of the Norton tradition ranged from the Alaska Peninsula to the western Canadian Arctic. Coastal sites are the largest and most numerous and pottery is found in abundance at these sites. Interior sites are also present in the hinterland of the Bering Sea coast and on the Alaska Peninsula. Pottery is often absent at inland sites, though there are some important exceptions, such as the inland sites of the Naknek and Brooks River drainages of the Alaska Peninsula. Some of these sites were quite substantial while others were only briefly occupied. The abundance of caribou antler in Norton assemblages, as well as the distribution of interior sites, indicates that caribou was still an important prey species (Dumond 2000). It has been proposed that northern Norton sites were short-term spring–summer campsites, while larger, year-round sites were located further to the south (Ackerman 1998).

On the Alaska Peninsula the Norton tradition appeared around 2300 BP after a millennia-long hiatus, probably caused by a catastrophic volcanic event. Dumond (1981) distinguishes three subsequent phases during this early period of pottery manufacture on the Alaska Peninsula. He refers to them as the Brooks River Period, including the Smelt Creek, Brooks River Weir and the Brooks River Falls phases. River fishing again became the primary economic focus on the peninsula (Dumond 1998). The geographical character of the peninsula might have complicated contact between groups living on either side of the Aleutian Range. On Takli Island on the Pacific coast of the peninsula, Norton pottery appears only around 1800 BP. Further to the southwest, near the Chignik River, Norton-like features are present but pottery is lacking. Farther to the southwest pottery was found along the Ugashik River (Henn 1978, Dumond and Scott 1991).

The pottery of the Norton tradition does not differ much from what is known of earlier Choris times, but it became much more common. Generally the pots were thin walled (thickness ranging from 3 to 10 mm), fiber tempered and relatively well fired. Based on its decoration, pottery was previously divided into two distinctive types: Linear stamped and the much more common Check stamped type, also seen on Nunivak Island (Griffin and Wilmeth 1964). Both types occurred simultaneously until around 1900 BP when Linear stamped pottery disappeared (Dumond 2000; Griffin 2002). Most of the early check stamp decorations appear on vase-like pottery with a narrowed rim (Figure 6.6 and 6.8a), although bowl shapes are also mentioned (e.g., on Nunivak Island) (Dumond 1969: 26). Early pottery was flat based with walls flaring out (Griffin and Wilmeth 1964). Somewhat later

cylindrical and barrel-shape pots predominated (Figures 6.6 and 6.7) (Dumond 1969; Frink and Harry 2008). As time progressed pottery tended to become thicker and coarser (Dumond 1969; Dumond 1984).

Later Ceramic Traditions

Thule Culture History

By 1000 BP the Norton tradition became subsumed by the Thule in the entirety of Alaska, and Norton pottery of the south-west was replaced by the relatively crude and thick pottery of the Western Thule tradition (Figure 6.8c and d) (Dumond 2000, Dumond 2005). The classic Thule culture is mainly known for its specialized maritime economy (especially bowhead whale hunting), and the rapid migration from Alaska to the eastern Canadian Arctic and Greenland around 1000 BP. Characteristic of Thule culture are semi-subterranean houses that were partly constructed by the use of whale skeletal elements (Crockford 2008). Whaling subsistence industries seem to have arrived in Alaska fully developed but it is unclear where this practice originated and evolved. Possible origin regions are the Aleutian Islands, where sea ice-edge exploitation was already practiced around 4700 BP (Crockford 2008), and the coastal areas of Chukotka (Mason 1998).

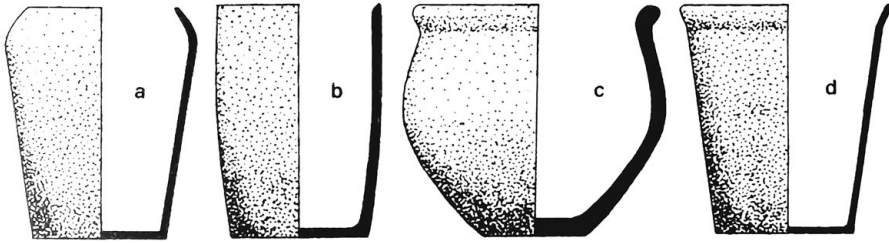
On St. Lawrence Island, the Punuk Islands and Nunivak Island archaeological finds indicate an early Thule-like presence at 1800 BP termed the Old Bering Sea culture (Dumond 1969). Crockford (2008: 114) has described Thule culture as “not adapted to a specific migratory resource (i.e. bowhead



6.6. Norton pottery of the Smelt Creek phase (#1025). (Photograph: M. Admiraal, courtesy of the University of Oregon Museum of Natural and Cultural History)



6.7. Norton pottery of the Brooks River Weir phase (#1022). (Photograph: M. Admiraal, courtesy of the University of Oregon Museum of Natural and Cultural History)



6.8. Profiles of pottery from the Alaska Peninsula, Brooks River: (Norton): (a) Smelt Creek; (b) Brooks River Weir and Falls phases; (Thule): (c) Brooks River Camp phase; (d) Pavik phase. (Reproduced from: Dumond (2005) figure 28, courtesy of Dr. Don Dumond)

whales), but to a particularly mobile habitat (the southern edge of the seasonal sea ice)”. The economic focus of the Old Bering Sea culture was exclusively on marine resources such as walrus, seal and, to a lesser extent, whale (Mason 2009). The pottery of this culture was termed St. Lawrence Corrugated. Just like with Norton pottery, it is fiber tempered. However, it is thicker and cruder, similar to Thule-style pottery. Pots are generally cylindrical with rounded bases and thickness varying from 10 to 15 mm (Oswalt 1955). This pottery type is generally absent from the Alaskan mainland with the exception of a few isolated finds. On St. Lawrence Island an early shift occurred towards more coarsely tempered pottery termed St. Lawrence Plain. This pottery is generally viewed as part of Thule. Because this shift occurred much earlier on the Bering Sea islands than it did on the Alaskan mainland, it has been proposed that Thule influence originated in Northeast Asia and arrived in Alaska through the Bering Sea region (Oswalt 1955, Dumond 2006).

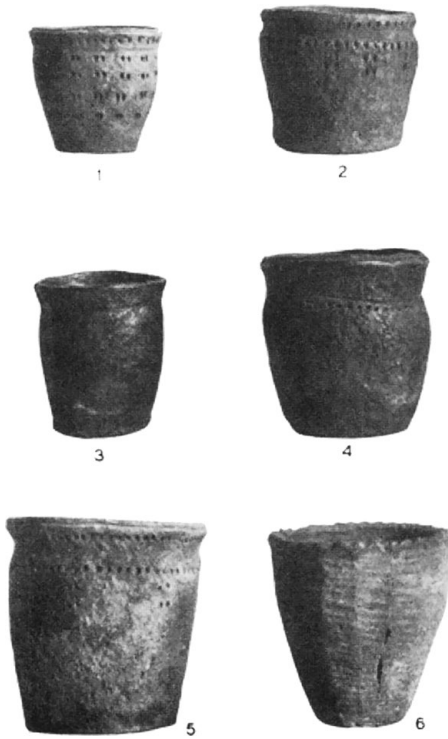
McGhee (1970) was the first to connect the development of Thule culture to climatic changes. Whereas the Neoglacial (4700–2500 BP) possibly created the conditions for the development of a sea ice-edge subsistence specialization in the south (Crockford 2008), the later Medieval Warm period (1100–800 BP) brought on warmer conditions. Sea ice retreated and open water conditions lasted longer, which attracted whales. Because of the warmer conditions the sea ice in the Bering Strait started to break up seasonally, allowing for whale migrations into the Chukchi Sea. As this process was shaping up, Thule culture, and the exploitation of whales developed (Stanford 1976; Crockford 2008). As the sea ice retreated further to the north, Thule people, specialized in the utilization of this sea ice-edge environment, moved along with the ice and eventually spread to the Canadian Arctic and Greenland. Crockford (2008) argues that this migration may not necessarily have taken place on land but, rather, over water and ice. The use of kayaks and dog sledges along the sea ice-edge may have facilitated the speedy migration.

The expansion of Thule into Southwest Alaska was different. Here, people of the maritime and riverine-focused Norton tradition were already present.

The Thule influence in Southwest Alaska may well have included an influx of new people but there is no clear evidence of a substantial population replacement. Nevertheless, the shift from Norton to Thule culture is clearly defined in the archaeological record and evidently occurred quite rapidly (Dumond and Bland 2006; Dumond 2011). On the Alaska Peninsula continuity is evident, though some changes are notable as well. The Thule period, locally referred to as the Naknek period, was subdivided by Dumond (1981) into two phases: the Brooks River Camp phase and the Brooks River Bluffs phase. During the BR Camp phase, starting around 850 BP, the use of polished slate intensified and pottery gradually changed. At first, the temper changed from organic to gravel and only after that did the shape of the pots change (Figure 6.8c–d). Thule pottery was crude, tempered with pebbles or gravel and thick walled. In many aspects it seems inferior to the earlier Norton pottery. Why Norton pottery was replaced by Thule pottery remains unknown. Could this have had to do with changes in subsistence strategies and subsequent function? Jordan and Zvelebil (2009: 53) point out that fiber-tempered pottery is more susceptible to damage from direct heating than gravel-tempered pottery, and mention the possibility of the use of the former for stone boiling while the latter was better suited for direct heating. What change in subsistence and cooking practices could have led to such a change?

The Classic Thule of the Canadian Arctic took maritime subsistence practices to a new level with a greater emphasis on hunting migrating whales. In Southwest Alaska the focus on whaling did not vary much from the earlier times of the Norton period. It was not until 800–600 BP that large whaling villages started appearing along the coast. Additionally, at this time interior settlements also expanded (Whitridge 1999). Subsistence in the interior was mainly focused on salmon and caribou. Other additions to the diet were bird, beaver and bear, and seasonally, the Pacific coast was visited for the hunt of various marine mammals. Pottery was generally confined to the coastal areas (Dumond 1984).

Around the beginning of the Little Ice Age (AD 1300/650 BP) a large volcanic eruption covered the Alaska Peninsula in a thick layer of ash. This event possibly caused the abandonment of the region for a short period of time. From 480 BP, the Naknek region was reoccupied, marking the beginning of the Brooks River Bluffs phase. Pottery became less abundant and changes in form to a broader type with flat bottoms and thinner, more erect sides (Figure 6.8d) were seen. Various clues point to a close relation with Kodiak from this period onwards, among them the use of the Alutiiq language and the practice of incising beach cobbles, and eventually the adoption of pottery in Southwest Kodiak. People still relied on a combination of terrestrial and aquatic species, which was similar in the Yukon-Kuskokwim Delta. Ultimately caribou remained the most important subsistence resource. The animals provided meat, hides, sinew, fat, bone and antler for food, as well as



6.9. Thule pottery collected along the Kuskokwim River in the late 1800s. (Reproduced from Gordon 1906: PL. XXIII, courtesy of Penn Museum)

the production of tools (Whitridge 2001). Salmon fishing was important during late summer to early fall when large quantities of salmon migrated up the rivers. A new addition to the diet on the peninsula was beluga whale, as evidenced at the Leader Creek site (Dumond 2003). An isotope study of human hair from the Nunalleq site near the Kuskokwim River around 650/570 cal BP showed evidence of a mixed diet (Britton et al. 2013). Maritime resources were still important in the diet, but it was mixed with terrestrial meat and/or lower trophic level fish (e.g., salmon). Whitridge (2001) states that people in Southwest Alaska were “so reliant on fish, including large marine fishes and several species of salmon, that their economies bear little resemblance to those conventionally associated with Eskimo peoples” (p. 18).

Thule Pottery: Shape and Technology

Thule pottery, or “*egan*” in Yup’ik language, is typically thick walled, coarse gravel or pebble tempered and poorly fired (Figure 6.9) (Stanford 1976, Dumond 1984). Various types of Thule pottery were defined by Oswalt (1955), including Seward striated, Yukon line-dot, Yukon lined in the north, and Hooper Bay Shell striated and Hooper Bay zigzagged further to the south. The distinction between these types is generally based on variations in decoration, technology (e.g., temper, thickness) and shape. The function and manufacture of pottery remains poorly understood, although some recent studies have focused on performance and manufacture (Frink and Harry 2008; Harry and Frink 2009; Harry et al. 2009). The role of pottery in wider food processing remains unclear. Thule pottery is substantially different from Norton. It is crude, thick walled and coarse, and at first sight seems poorly made. Pottery vessels usually have flat bottoms with straight to lightly flaring walls, and are generally small in size with diameters varying from 10 to 30 cm. This shape is poorly suited for general cooking methods because it is easily affected by thermal shock. Temper is usually sand or stream rolled pebbles sometimes as large as 10 mm in diameter. This leads to fragile vessels that crumble easily and fall apart in irregular breaks. However, the mineral temper

does make the pottery more resistant to direct heating. In order to make the pottery waterproof, oil may have been mixed in with the clay, and vessels could have been coated with oil before firing and afterwards at regular intervals. There is also mention of the addition of bear's blood to the clay paste (De Laguna 1939; Murdoch 1892). Thule pottery seems poorly suited for cooking, nevertheless it was used for it (Frink and Harry 2008).

Frink and Harry (2008) investigated methods of manufacture as well as the use of Thule pottery by looking at archaeological data, ethnohistorical reports and current indigenous knowledge. They found that Thule pottery was primarily manufactured using "slab construction" where the walls of the pot were built up vertically upon a slab of clay forming the base. This allowed the pot to be constructed without the necessity of intervals for drying, as may be necessary when walls are constructed by coiling. The Arctic environment was a limiting factor for the possibilities and timing of pottery manufacture. Circumstances were often too cold and damp to successfully dry and fire pottery, which affected quality (Frink and Harry 2008).

Ethnographic sources tell us that parboiling through direct heating, rather than stone boiling, was the preferred cooking technique in late prehistoric times. Sources indicate that fully cooked meat lacks flavor, leading to a preference for meat that was only partially cooked. As the meat only needed to be parboiled for a moment, it could be cooked successively in one container, making large cooking containers unnecessary. This method of cooking preserved nutrients, such as vitamin C, which is of major importance in the diet of Arctic people. It also limited fuel use and cooking time (Frink and Harry 2008). Harry and Frink (2009) stress that just because food was consumed raw that does not mean that Thule food preparation was not culinary sophisticated. On the contrary, the method of storing food by fermentation, drying or freezing and subsequent defrosting and preparation, plays a significant role in the taste and texture of a meal and therefore determines its quality (Starks 2007). As stated by Harry and Frink (2009: 335), there is a "biological and cultural desire for a diversity of tastes and textures" which possibly led to the use of ceramic pots in cooking and storing practices.

Recently, Solazzo and Erhardt (2007) as well as Farrell et al. (2014) specified that Thule pottery at specific sites was used exclusively for marine foodstuffs. However, this occurred in the context of a wider subsistence pattern where marine resources were not exclusive, as was evidenced by Britton et al. (2013). Could it be that Thule pottery was exclusively used for the processing of marine resources while other foodstuffs were processed differently? Anderson et al. (2017) showed that this was not the case at the Cape Krusenstern site complex. Organic residue and compound specific isotope results from both Norton and Thule pottery showed that freshwater aquatic species were the dominant resources processed in the pottery at this site.

The Koniag of Kodiak Island

The Thule tradition had a significant impact on the technologies used by populations in Southwest Alaska. On Kodiak Island, however, pottery was not adopted until around 500 BP (Clark 1966a; Clark 1998; Dumond 2000; Dixon 2014), despite the fact that the island's inhabitants probably knew of the technology through contact with people outside of the archipelago. The earliest archaeological evidence of an established human presence on the Kodiak Archipelago dates to approximately 7000 BP and is termed the Ocean Bay I and II cultures, succeeded by the early and late Kachemak. Both cultures had a strong reliance on marine resources (Clark 1998) and the Ocean Bay I people are thought to have been the origin of later cultures in the Aleutian Islands (Dumond 1977). Thule influence reached Kodiak around 1000 to 800 BP and things changed. Drastic stylistic as well as technological changes marked the dawn of the Koniag tradition. The transition from Kachemak to Koniag and the origin of the changes that accompanied that transition remains the subject of discussion (Dumond and Scott 1991; Knecht 1995; Fitzhugh 1996; Clark 1998; Steffian and Saltonstall 2009). Was the rise of Koniag culture the result of an in-situ development on the island or was it the result of contact with (or even a migration of) people living on the nearby Alaska Peninsula? Similarities between the two regions are striking. Changes include the use of large, multiple room houses, the use of sweat baths, petroglyph art, possible mummification and a sudden abandonment of bone needles (Clark 1998). One of the most striking changes was the adoption of pottery in the southwestern part of Kodiak Island.

The rich environmental setting of Kodiak Island led to an almost exclusively maritime focus of the island's inhabitants. To the east lies the East Aleutian Trench, dropping down 6 km. Due to upwelling, currents bring minerals and nutrients to the surface. The area forms one of the world's most productive ecosystems. Marine mammals such as whales, seals, sea lions, porpoise and sea otters are abundant, as are various species of fish (Knecht 1995). To the people of the Koniag tradition, salmon fishing was of great importance. During the period of late spring to late summer, salmon migrates up the streams and rivers of the Kodiak Archipelago to spawn. Here they were harvested by the Koniag using fishing weir technologies and spears (Steffian and Saltonstall 2009). Summer fishing camps were located upstream in the many rivers, but also near river mouths where the salmon could easily be intercepted.

Large and more permanent villages were located along the coast where subsistence was focused not just on fishing but also on the hunt of marine mammals. Shellfish was also an important resource as evidenced by numerous midden deposits and even the transport of clams from the coast to upstream fishing camps (Clark 1998). The Koniag also practiced whaling. They used long and slender ground slate dart tips that were very different from the Eskimo harpoons used to hunt whales further to the northwest. Ethnographic

reports mention that the dart tips were dipped in a poisonous substance derived from a mix of monkshood and human fat rendered from prominent deceased whalers. The dart would poison the whale after which it would wash up on shore within a few days (Lisianski 1814 in Lantis 1938: 452). Whaling was a specialized practice in Southwest Alaska and whalers had a special status. During the whaling season they were often separated from the village and lived in caves. While maritime resources were of superior importance to the Koniag, there is also evidence of the use of the terrestrial resources of the island such as foxes, brown bear, roots and berries (Clark 1998).

Pottery is only found in the southwest of the archipelago and the technology was apparently not employed in the north (Fitzhugh 1996). Clark (1998) argues that this may have to do with the migration routes of sea mammals and salmon runs, and thus emphasizes the importance of pottery in a maritime-focused subsistence economy. However, maritime subsistence economies were present all over the island and date to all times, and so the hunt for marine mammals could not have been the only reason for the limited distribution of pottery on the island. Saltonstall (personal communication, 2016) suggests that the limited occurrence of pottery may be connected to differences between the north and south Alutiiq dialect. Dumond and Scott (1991) touch upon the possibility of a migration of people from the Ugashik River area on the Alaska Peninsula towards Southwest Kodiak, where they might have introduced ceramic vessel technology.

Various historical ethnographic sources mention the use of clay vessels by the inhabitants of Kodiak (Lisianski 1814; Zolotarev 1938; Hrdlička 1944; Heizer 1949) or the knowledge of use in the past (Holmberg 1856). Some interesting remarks are noted regarding the preparation and consumption of food, such as that some things are eaten raw but “other food is cooked in earthen pots,” similar to the Aleutian Islands (Lisianski, 1814: 74). The account of Khvostof and Davydov (1810–1812: 104, cited in Heizer 1949: 48) in which they describe the rendering of marine mammal fat to oil is in line with archaeological theories: “from clay they make saucers in which they melt whale fat”. Lamps were used to burn sea mammal oil for light, not for cooking, which was done on fires fueled with wood (Fitzhugh 1996). Heizer (1949) described Kodiak pottery as “an excellent technological product,” while at first sight one might judge it to be “crude and technologically poor” (p. 49). It is made using the paddle and anvil technique, well fired with a hard surface and coarsely tempered using crushed slate, granite or pebbles sometimes as large as 15 mm; organic temper is absent. The shape of vessels varies but pots are generally large. De Laguna (1939) mentions a cylindrical shape with a pronounced shoulder and Clark (1966b: 160) describes a vessel shape with a “flat-bottomed inverted conical lower half and cylindrical, sometimes slightly concave or tapered, upper wall” (Figure 6.10). Both flat and rounded bottoms are described in the literature.



6.10. A typical Koniag pot. (Adapted from: Clark, 1966: figure 7, courtesy of the University of Wisconsin Press)

THE “EXTINCTION” OF THE CERAMIC CONTAINER TRADITION

The arrival of Russians and Europeans lead to the end of pottery use in the Arctic. Eventually rival container technologies such as metal pots replaced all functional pottery in Alaska. This process differed between regions. In the Canadian Arctic, the Classic Thule culture had already abandoned the use of pottery by approximately 1000 BP and instead started using soapstone bowls. The absence of clay due to the geological location of the Canadian Shield must have been an important factor, just like the increased mobility during the widespread Thule migration towards the east. Over time, soapstone bowl technology was brought back west, to Alaska, and

has a relatively late occurrence north of the Kotzebue Sound (Morrison 1991). This led to the decline of pottery use in the north, but for a while the two technologies coexisted. During the contact period the metal pot was introduced to the people of Alaska. These vessels were more durable and less fragile. Only a few groups maintained the use of ceramic pots and only for ceremonial practices (Arnold and Stimmell 1983). The use of ceramic oil lamps persisted in Southwest Alaska until well into the twentieth century. However, pottery use declined sharply from the late eighteenth century on and was generally abandoned in the entire region by the mid-nineteenth century (Frink 2009).

CONTAINER EVOLUTION: INVESTIGATING PATTERNS IN TIME AND SPACE

The current state of knowledge discussed here has provided a general framework for the investigation of the evolution of container technologies in Southwest Alaska and enables the proposition of patterns throughout time and space. What drove the processes that lead to these patterns? The oldest vessels in Southwest Alaska are the stone bowls from the Aleutian Islands (8000 BP). These vessels are not well studied and their function remains unclear. The bowls may have been used for cooking or for the rendering of marine mammal fats into oil for burning in stone lamps. Stone bowls were mainly

in use during the Margaret Bay phase and were abandoned after 2000 BP. Griddle stones become more numerous in the archaeological record from 6000 BP onwards and may have been the rival technology that eventually replaced stone bowl technology. Despite their apparent knowledge of the technology (Johnson 2004), conventional pottery was never used by the Unangan people of the Aleutian Islands.

Pottery first appeared in Alaska near the Bering Strait with the maritime focused Norton (Choris) tradition around 3000 BP. By 2500 BP pottery was used in most of the coastal areas of mainland Alaska. Very little is known about the function of Norton pottery because research has mainly focused on shape, technology and decoration. Thule pottery, on the other hand, has received more attention. Whereas Norton was thin walled, fiber tempered and well fired, Thule was the opposite, thick, coarsely tempered and poorly fired. Why the well-made Norton pottery was replaced by the fragile and coarser Thule pottery is a question that has puzzled researchers for decades. The reasons are still poorly understood, although they are likely wrapped up in a larger process of cultural change brought on by the onset of Thule around 1000 BP. Frink and Harry (2008) argue that both time management and the environment were important factors that determined the quality of Thule pottery. However, Norton pottery was manufactured and used under very similar circumstances. Therefore, this cannot solely explain the low quality of Thule pottery. A functional difference may offer a better explanation for the differences between Norton and Thule pottery. It is possible that these pottery types were used for two different kinds of cooking, i.e., Norton may have been more suitable to stone boiling while Thule pottery, with its porous qualities, was better suited for direct heating.

The adoption of pottery by the Koniag tradition of Kodiak Island testifies to the far-reaching influence of the Thule tradition. The presence of certain artifacts, e.g., incised pebbles, on both Kodiak and the Alaska Peninsula, strongly suggest the possibility of contact between the two regions. This may have led to the adoption of pottery in the southern part of Kodiak. However, the incised pebbles seem to have been a Kodiak phenomenon that was adopted by people living on the Alaska Peninsula. Most pottery-bearing sites on Kodiak Island lack large quantities of incised pebbles with only a few per site, while sites lacking pottery on Northwest Kodiak yielded hundreds. Another interesting pattern is the lack of spruce root baskets on sites with pottery and vice versa. However, sites containing spruce root baskets are very limited and so this pattern may be coincidental (Patrick Saltonstall, personal communication, 2016). Clark (1998) suggests a possible connection between the limited occurrence of pottery on Kodiak Island and migration routes of marine mammals. This indicates a difference in subsistence, which led to the adoption of pottery in one place and not in another. However, subsistence strategies throughout the island appear to have been uniform and so it seems

that it was mainly the material culture of the Koniag tradition that was not uniform. The implications of these differences remain unclear.

Nonetheless, salmon fishing and the hunt for marine mammals were the most important subsistence strategies for all the pottery bearing traditions of Southwest Alaska. Sites of the Norton, Thule and Koniag traditions are confined to coastal areas and rarely found in the interior. This brings us back to one of the initial questions proposed in this chapter: What is the connection between the occurrence of durable container technologies such as pottery and stone bowls and a subsistence strategy specialized on maritime resources? A few studies using organic residue analysis have shown that pottery in Alaska was exclusively used to process aquatic resources (Solazzo and Erhardt 2007; Farrell et al. 2014a; Anderson et al. 2017). Only Anderson et al. (2017) employed the use of compound specific isotopes to further differentiate the results and showed the processing of freshwater organisms in pottery. Other evidence has indicated that the diet was not exclusively aquatic but mixed with terrestrial resources such as caribou and riverine resources such as salmon (Britton et al. 2013). This indicates a very specific role for pottery in the wider context of resource processing. The implications of this connection between maritime subsistence economies and the adoption of pottery remains largely unclear but can now be tested through the wider employment of bioarchaeological techniques such as organic residue analysis.

UNDERSTANDING FUNCTION: AREAS FOR FUTURE RESEARCH

Identifying the precise function of container technologies in these marine-oriented traditions is vital to answering key questions concerning the origin and evolution of vessels in Southwest Alaska, the Subarctic and beyond. In this chapter, some questions have been addressed and some have been raised. The main questions raised are 1) What was the function of durable container technologies in Southwest Alaska? 2) What made these vessels so important that people were willing to invest in them so extensively? And finally, 3) What is the nature of the proposed relationship between the adoption of pottery and the increased reliance on marine resources?

Future research is an absolute necessity for the understanding of function, patterns and the wider evolution of the various container technologies over time and space. As early as 1940, De Laguna (1940: 53) stressed the importance of understanding vessel function and shape in order to study the origin and development of Arctic and Subarctic container technologies. In general, the function of all the vessel types discussed in this chapter remains largely unclear. Previous research mainly focused on shape, technology and decoration. This is a major research gap. Of all vessel types, Thule pottery is best understood, a result of various recent studies (e.g., experimental, bioarchaeological,

ethnographic) that yielded interesting results about manufacture, performance and function (Solazzo and Erhardt 2007; Solazzo et al. 2008; Harry et al. 2009; Harry and Frink 2009; Farrell et al. 2014; Anderson et al. 2017). With these studies, and the advance of new research technologies, the first steps have been taken into a research direction that may prove to be very fruitful for filling in the gaps in contemporary knowledge of container technology function and evolution in Southwest Alaska and beyond. Filling in these gaps will lead to answers to specific questions raised in this chapter, such as: Did griddle stones functionally replace stone bowls? Why was Norton pottery replaced by Thule pottery? And why did pottery only occur in the southwestern part of Kodiak Island? It may also lead to a wider understanding of the larger process of the adoption of pottery in the research area. What were the driving forces for the initial adoption of pottery in Southwest Alaska? Did other durable container technologies such as stone bowls play a role in this process?

Many vessels in the study area have food residues left on their interiors. With the use of bioarchaeological techniques, and by analyzing lipids, isotopes and even proteins, the origin of these residues may be determined. Small scale studies using such techniques were undertaken by Farrell et al. (2014), Solazzo and Erhardt (2007), Solazzo et al. (2008), Jeanotte et al. (2012) and Anderson et al. (2017), and yielded very promising results. A systematic study of residues is the next step in researching the evolution of vessel function in this region. Container technologies played an important role in the everyday lives of prehistoric people in Southwest Alaska, otherwise they would not have invested in them so extensively. In the extreme environment of Subarctic Alaska decision-making processes are of great importance. Well-thought-out strategies are necessary for successfully getting through periods of scarcity during the long and cold winter months. Learning more about the role of container technologies and how they fit into the wider process of converting resources into food and fuel will help us better understand the choices and strategies deployed by maritime-oriented prehistoric peoples living in Southwest Alaska, but also in other extreme environments across the circum-polar North.

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NOTE

- 1 All dates are uncalibrated radiocarbon years before present unless indicated otherwise.

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SEVEN

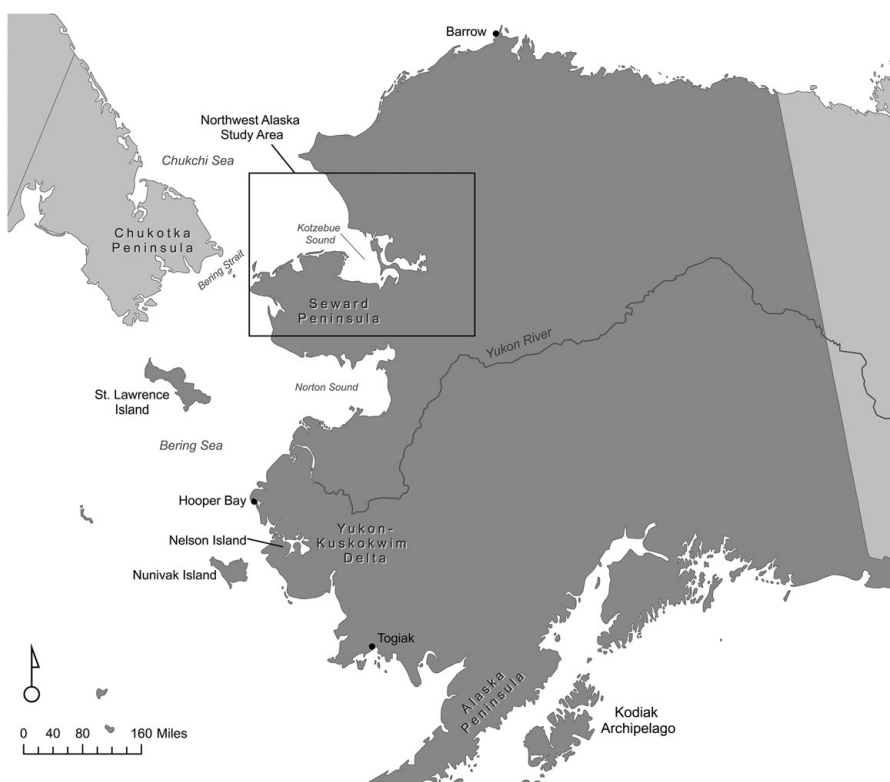
ETHNOGRAPHIC AND ARCHAEOLOGICAL PERSPECTIVES ON THE USE LIFE OF NORTHWEST ALASKAN POTTERY

Shelby L. Anderson

INTRODUCTION

Ceramic vessel fragments are abundant in late Holocene coastal Alaskan archaeological sites and until recently, research on northern cooking vessels focused primarily on chronological questions (e.g., Oswalt 1955). A growing body of literature on hunter-gatherer ceramic technologies around the world (Barnett and Hoopes 1995; Eerkens 2002, 2003; Eerkens, Neff and Glascock 2002; Jordan and Zvelebil 2009) has contributed to renewed interest in the study of northern ceramic technology to address questions of mobility, interaction, diet, food practices, technology and the social role of ceramic vessels (Anderson, Boulanger and Glascock 2011; Anderson et al. 2016; Anderson, Tushingham and Buonasera 2017; Farrell et al. 2014; Frink and Harry 2008; Harry and Frink 2009; Ponkratova 2006). New research that draws data from both archaeological and ethnographic sources raises interesting questions about how pottery was made and used, and highlights the need for additional in-depth investigation of both the social and technological aspects of northern pottery.

This chapter presents a case study of northern Alaskan pottery traditions (Figure 7.1). The aim is to understand the role of pottery in past northern hunter-gatherer lifeways. To achieve this, I adopt a use-life perspective and investigate how pottery procurement, production, use and discard was incorporated into past hunter-gatherer seasonal activities. I analyze ethnographic



7.1. General location map of the Alaska study area, including locations of ethnographic research discussed in main text. (Map drawn by Justin Junge)

literature from across western and northern Alaska and use this to interpret the results of new archaeological research on Northwest Alaskan pottery. I find that mobility and environmental constraints unique to northern Alaska shape the character, production and use of ceramic vessels, which required a considerable input of valuable time and resources. This case study highlights both the complexity of making pottery at northern latitudes and the time investment and technological skill required of northern potters to resolve these challenges. The technological and social roles of pottery were important enough that people invested resources in pottery making and use despite the challenges. This research also identifies several links between pottery and the consumption of aquatic resources, suggesting a possible explanation for the development and persistence of such a difficult craft tradition.

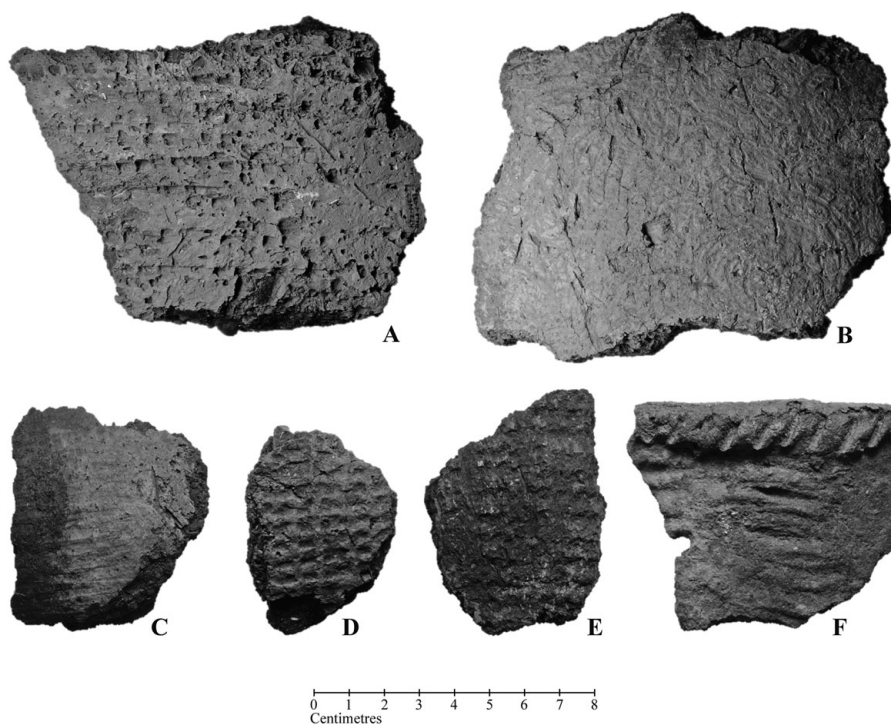
NORTHERN ALASKAN CERAMICS: OVERVIEW

Ceramic technology was adopted in northern North America sometime between 2,500 and 3,000 years ago and subsequently spread north and south along the coasts of Alaska. The earliest sites are in the Bering Strait region

(Ackerman 1982). By 1,000 years ago, pottery was in use as far east as the Mackenzie River in the western Canadian Arctic and as far south as the Kodiak Archipelago. This ceramic technology likely has its origins in earlier Russian Far East traditions that spread to the Chukotka Peninsula and Magadan region by 5,000 years ago (Ackerman 1982; Anderson et al. 2017; Dumond and Bland 1995). Northern Alaskan ceramic technology can be classified broadly as falling into two traditions, Paleoeskimo (pre-1,000 years ago) and Neoeskimo (post-1,000 years ago) ceramics. While early Paleoeskimo ceramics are relatively rare, 105 known sites are dated to before 1,500 years ago (Anderson et al. 2017); later Neoeskimo ceramics are more common and are found at most residential sites in the western Arctic dated to after 1,000 years ago. Note that while this chapter is focused on the most common Alaskan ceramic material – ceramic cooking vessels – there are also ceramic bowls, cups, lamps, balls and figurines reported in small numbers from sites across coastal Alaska.

There are regional differences within Paleoeskimo and Neoeskimo traditions in terms of surface treatments, common temper types and vessel shapes. Generally, Paleoeskimo pottery vessels are thinner and harder than Neoeskimo vessels, which tend to be thick and crumbly. Although sample sizes are small, the earliest Paleoeskimo pottery vessels appear to have had a rounded bottom and various types of cord marked, linear or check stamped surface treatments. Later Paleoeskimo vessels have more of a barrel shape with a flat bottom, although this sample is skewed towards Southwest Alaska and may represent a regional variant rather than a broader evolution in Paleoeskimo ceramic form. Neoeskimo vessels are also flat bottomed, and range in shape from cylindrical to an everted flowerpot shape. In northern and Northwest Alaska, organic and mineral temper are common in both Paleoeskimo and Neoeskimo vessels, although Neoeskimo vessels have a much coarser paste texture and higher temper content. Surface treatments include various check, corrugated and curvilinear stamped patterns, as well as line-dot designs and textile impressions (Figure 7.2) (see Anderson et al. 2011; Dumond 1969; Griffin and Wilmeth Jr. 1964; Oswalt 1955 for more information). Changes in ceramic character over time – from a higher investment technology to a lower investment, or expedient, technology – could be related to changing cooking practices. Alternatively, earlier Paleoeskimo ceramics may have had greater importance in a social context (e.g., as prestige items) than later Neoeskimo ceramics. I explore these issues in more depth in a subsequent section on pottery use.

Paleoeskimo ceramic technology in northern North America is reported at relatively few sites, particularly before 2,300 years ago (Anderson et al. 2017). The majority of pre-2,300-year-old materials are found between Kotzebue Sound and Nunivak Island on the Yukon-Kuskokwim Delta (Figure 7.1). These earliest ceramics were primarily recovered from coastal seasonal or logistical foraging sites (i.e., surface scatters), in part because few more



7.2. Examples of Northwest Alaskan ceramic surface decorations: A) Dentate stamp, B) Curvilinear stamp, C) Corrugated, D) Waffle stamp, E) Textile impression (there are many variations), F) Seward striated, or Striated. (Photos by Alexandra Vincent, figure prepared by Justin Junge). (Images B, C, E and F, courtesy of the University of Alaska Museum of the North and the Bureau of Land Management)

permanent dwellings are known from this time period (but see Giddings 1957). Early ceramic recovery is restricted almost entirely to surface collection from disturbed contexts such as deflated dune environments (Schaaf 1988). As a result, we know very little about the context of early ceramic production, use and discard. Between 2,300 and 1,000 years ago Paleoeskimo ceramics had a wider distribution, extending southwest to the Alaska Peninsula. Ceramics dating to this period were recovered from a variety of contexts, e.g., surface scatters, houses, middens. Note, however, that there is a gap in the northwest and northern Alaskan ceramic record between about 2,000 and 1,000 years ago that may be due to abandonment of ceramic technology during this period by people associated with Ipiutak culture (Larsen and Rainey 1948). Ipiutak people may have abandoned pottery use due to increased mobility, or an increased reliance on wood, rather than oil, for heating (Mason 1998, 2004).

After 1,000 years ago Neoeskimo ceramics became abundant and had a much wider geographic distribution than Paleoeskimo ceramics, likely reflecting the spread and influence of Neoeskimo culture across the North. Ceramic materials are found at most sites during this period, and in much higher

numbers than in Paleoeskimo contexts. Number of sherds is, of course, partially a product of ceramic durability and post-depositional processes that cause fragmentation; low fired and organic tempered Neoeskimo sherds common in northern Alaskan sites are particularly susceptible to freeze/thaw fracturing (Skibo, Schiffer and Reid 1989). At a coarse level, however, the increase in abundance and ubiquitous distribution of Neoeskimo ceramics suggests increased reliance on ceramic technology during this time period.

THE USE LIFE OF NORTHERN ALASKAN COOKING VESSELS

While archaeologists have established a general understanding of northern Alaskan ceramic types and their distribution, many questions remain about the social and technological role of pottery in hunter-gatherer lifeways. Ceramics are difficult to make and use in the cold, damp, northern climate, yet northern Alaskans persisted in ceramic making for 2,800 years. Why? How did people balance the costs of producing pottery with the possible social and/or technological benefits? In the following sections I consider these general questions more specifically through a Northwest Alaskan case study. I integrate insights from new archaeological research in Northwest Alaska with ethnographic data from across northern and western Alaska and evaluate the many challenges involved in making and using ceramic technology in a northern setting. I consider the use life of pottery vessels from raw material procurement to vessel discard (Skibo 2013) to better understand how pottery making and use fit into the northern hunter-gatherer lifestyle. Pottery making in a northern context cannot be understood in isolation from other activities; as such, it is helpful to consider how various stages of pottery use life are embedded in hunter-gatherer “taskscape” (Michelaki, Braun and Hancock 2015).

Raw Material Procurement

Clay is, of course, the primary ingredient in northern cooking vessels. Until recently, only limited research was directed at clay procurement in northern Alaska context (e.g., Lutz 1970). An implicit assumption in northern ceramic studies has been that clay and temper material appropriate for making pottery was widely available. One would further assume, therefore, that people used clays located close to production sites to make the majority of their pottery. Review of northern and western Alaskan ethnographic literature and unpublished data indicates, however, that this may not always have been the case; clay appropriate or preferred for pottery making was not widely distributed (de Laguna 1947; Giddings 1961; Lucier and VanStone 1992; Spencer 1959).

Various interviewees from across northern and western Alaska indicate that people had preferred clay sources for pottery making in some cases (Noatak

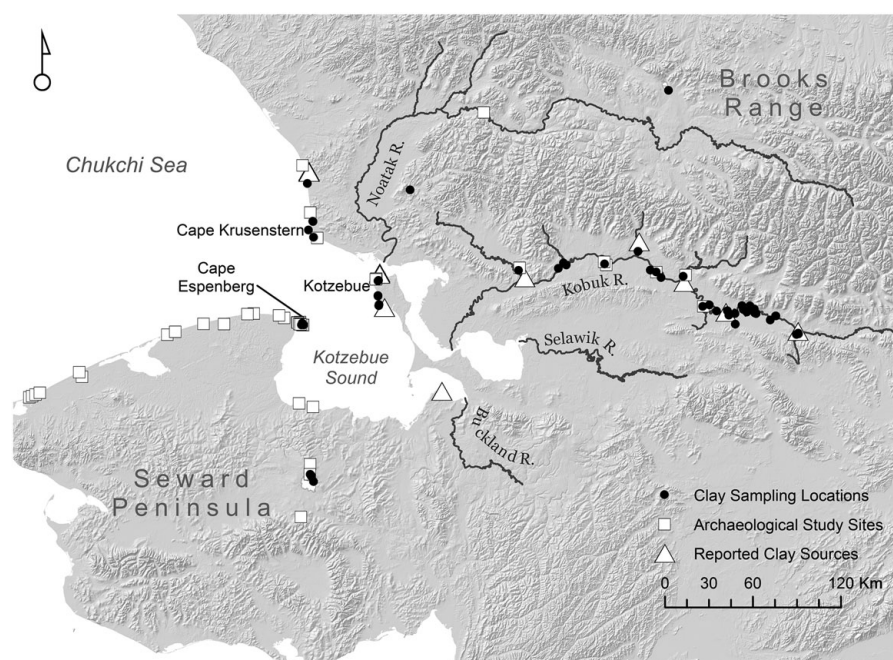
(and Kolerak 1987; Smith 1986) and that they would trade for the clay they preferred if it was not available locally (Lee et al. 1990; Spencer 1959). Unfortunately, no details on the characteristics of preferred clays have been reported. In addition to being a source of various pigments, clay from Nelson Island, located in western Alaska (Figure 7.1), was sent to neighboring villages on the coast where clay was not available or where Nelson Island clay was preferred over local sources (Fienup-Riordan 1975; Friday 1983; Oswalt 1952). Procurement of clays from more distant western Alaska locales even when easily accessible clays were present locally is reported on Nelson Island (Fienup-Riordan 1975) and in Northwest Alaska (Spray 2002). People on St. Lawrence Island reportedly traveled twenty-five miles (forty kilometres) from what is now Savoonga to collect clay at the edge of a lagoon (Geist and Rainey 1937). Together these data indicate that people had specific requirements, some of which are unknown or cannot be quantified, for clay used in pottery making. Clays well suited for pottery making located close to ceramic production sites may not have been used due to cultural preferences for more distant sources. In the nineteenth century, people traded for ceramics made in other regions even when local sources of clay and local pottery was available (e.g., Burch 1998, 2005; Ray 1975). It is highly likely that similar behaviors extend into the past, shaping the archaeological record of clay procurement, ceramic production and distribution.

Ethnographic data from both northern and western Alaska indicate that clay was used for a variety of other purposes in addition to cooking vessel construction; these varied uses are likely one reason that knowledge of clay sources persisted in many regions, several generations after pottery making ended (e.g., Ballot and Ballot 1987; Kugzruk 1987; Lee et al. 1990; Noatak and Kolerak 1987). Examples of clay uses include in lamp making (Fienup-Riordan 2007, p. 272), fish storage (Amos and Amos 1986; L. Smith 1986, 1989; P. Smith 1990) and for medicinal purposes (Ballot and Ballott 1987). Nelson Island “clay” pigment sources were particularly valued for decorating a variety of objects (Angaiak 1984; Fienup-Riordan 2005, 2007; Kailukiak 1984; Kolerok 1986) and were traded across western Alaska (e.g., Hendrikson and Hendrickson 1991; see Anderson 2016 for more discussion). Kugzruk (1987) mentions clay used to make children’s toys; clay balls were used as part of a children’s game on the lower Yukon River and in the Norton Sound region (Fienup-Riordan 2005, p. 252).

These ethnographic data from across northern and western Alaska indicate that additional research is needed to better understand the ways in which clay availability, distribution and character factored into a potter’s raw material procurement activities. To assess this at the regional and local levels most likely to have been important to a potter, I undertook a clay survey in the Kotzebue Sound region of Northwest Alaska (Anderson 2016) (Figure 7.1). Reconnaissance

survey was directed at locating and sampling ethnographically known sources and areas at or near archaeological study sites (Figure 7.3). Survey of the coast around Cape Krusenstern, Kotzebue and Cape Espenberg, and interior areas along the Kobuk River and in the Imuruk Basin of the Seward Peninsula relocated all of the ethnographically reported sources. Several additional sources were identified in the field; some were reported by local residents and subsequently located by the survey. Multiple clay deposits were identified along the Kobuk River and along the north and central coasts of Kotzebue Sound. Clay suitable for making pottery, however, was not found on the southern coast or in the interior of the Seward Peninsula. Subsequent geochemical study of clay and ceramics showed that past people did not use all of the available clays even when they were located near presumed ceramic production sites. While much of this vast region has not been surveyed for clays, this initial survey generated several key insights into the pottery production process. Specifically, the survey revealed that pottery-quality clay is not evenly distributed across Northwest Alaska and that available clays were not always used by potters.

A variety of temper materials are known from ethnographic and archaeological analysis across northern and western Alaska. Temper materials noted in archaeological assemblages include gravel or mineral temper, grass and other



7.3. Northwest Alaskan sourcing study area. Archaeological sites, reported clay sources and locations where clays were sampled for INAA. Additional clay deposits were identified during the survey but samples were not collected. (Figure drawn by Justin Junge)

fibers, fur or hair and feather (e.g., Dumond 1969, Griffin and Wilmeth Jr. 1964; Oswalt 1955). In western Alaska during the ethnographic period, Annie Blue (1999, p. 28; Fienup-Riordan 2005) of Togiak (Figure 7.1) describes the use of various tempers in pottery production: “They didn’t use only the clay. They would mix the clay with other things such as ashes. Aged fish eggs were also used when assembling the clay. Anything can be added to make the clay thick when they make pots.” Blue also mentions use of fish livers, clay chips (possibly ceramic fragments), dog feces and sand as temper (Blue 1999). Harry et al. (2009a, 2009b) explore the addition of oil and blood to clays in their experimental production of Thule vessel replicas. They find that addition during production actually decreased clay workability and conclude that ethnographic accounts of blood and oil use may have been referring to application following firing. Use of clay with natural temper is mentioned on St. Lawrence Island and on the Yukon River (de Laguna 1947: 39; Geist and Rainey 1937) (Figure 7.1). Nelson Island people used crushed volcanic rock as a temper (Fienup-Riordan 1975: 13), while people from Hooper Bay sometimes included dog hair or manure in addition to crushed rock (Oswalt 1952).

In the Northwest Alaskan case study, low magnification analysis of 3,772 ceramic sherds from seventeen study sites (Figure 7.3) shows that both mineral and non-mineral tempers were frequently used in both Paleoeskimo and Neoeskimo ceramic materials (Anderson 2011). Non-organic temper was most common, although it is possible that at least some of the non-organic inclusions were part of the raw clay source rather than an addition during vessel production. Many possible clay sources identified by the Northwest Alaska source provenance survey had mineral inclusions in the size ranges observed in ceramic thin-section. Feather was the most commonly identified organic temper, with shell and bone used only occasionally. An initial assessment of temper size and abundance was made during low magnification analysis, but later high magnification analysis of sherd thin sections yielded different temper size and density information. This indicates that low magnification analysis of dark, highly reduced, Northwest Alaskan sherds is unreliable and temper estimates made using this method of analysis should be disregarded (Anderson 2011: 125).

Overall, variability in temper type, size and abundance in the Northwest Alaska study area suggests people simply used materials that were available to them and that worked with their chosen clay. This is consistent with ethnographic descriptions of people in northern and western Alaska tempering clay with materials that were on hand and in contrast to the various ethnographic descriptions of selective clay use described previously. This suggests that potters were making clay and temper choices based on factors outside of, or in addition to, the performance characteristics of different temper and clay combinations. For example, if finished vessel weight was a priority for

Northwest Alaskan potters, experimental studies (Reid 1989; Skibo et al. 1989) indicate that one would expect higher rates of organic versus mineral temper than those observed in this study of Northwest Alaskan ceramics. Or, if heat retention was a desired outcome, vessels would be tempered with predominantly mineral temper. Variability in temper use suggests that other unknown factors were important to potters.

Production

In western Alaska, ethnographic accounts indicate that vessels were often formed from a lump of paste using a smooth rock on the interior of the vessel and a wooden or skin-covered paddle on the exterior (e.g. Fienup-Riordan 2005: 133). Forming of vessels over baskets or in birch bark molds is also mentioned in a few western Alaskan ethnographic cases (de Laguna 1947: 141; Fienup Riordan 2007: 48–49). Analysis of seventy-seven Northwest Alaskan thin sections provided new insights into previous ethnographic accounts of pottery production (Anderson 2011). For example, cracks in ceramic fabrics usually had an orientation parallel to the wall of the sherd, supporting the inference that ceramics were made using a paddle and anvil technique (Rye 1981). High variability in inclusion density and character within a single thin section suggests the addition of patches of clay during vessel production, or perhaps during later repairs. Thin black layers on the interior and exterior surfaces of several sherds may be from the application of oils or other organic material during production or use. Fiber impressions on the interior and exterior of a small percentage of ceramics from Northwest Alaska suggests that the use of molds occurred prior to contact as well. The basketry impressions themselves are an interesting window into fiber technology of this region, little of which is preserved in the archaeological record. Various carved paddles, cord-wrapped paddles and other implements were used to stamp or incise finished vessels. Some surface treatment types have a broad geographic extent and are found across much of Alaska (e.g., variations on early and later check-stamping and curvilinear designs), but regionally specific designs are known as well (e.g., line and dot patterns from the Norton Sound and Yukon-Kuskokwim region, Seward striated design from the Kotzebue Sound region). There appears to be greater diversity in local designs during the late pre-contact period, at least in the Kotzebue Sound region (Anderson 2011). This could be due to shifts in mobility patterns due to the introduction of dog traction or a reorganization of regional exchange systems.

Ethnographic reports indicate that after sun drying, pottery was fired in open pits in uncontrolled conditions. On St. Michael Island, in western Alaska, a fire was built inside and outside of the vessel itself; the vessel was then heated to the highest temperature possible (Nelson 1983; Oswalt 1952). Vessels were

often oiled with marine mammal fats before, during and after the firing process; burnt fish eggs or blood was sometimes used instead of, or in addition to, oil (Fienup-Riordan 1975; Reid 1989; Harry et al. 2009a, 2009b; VanStone 1989: 171). Spencer (1959: 472) describes the firing process on the north slope. Vessels were dried first in the sun and placed in a fire and turned until fired. The fire itself was often built with driftwood soaked in oil. A similar process is described on St. Lawrence Island (Geist and Rainey 1937) where seal oil saturated fuel was placed over the vessel to provide more even heat. On Nunivak Island, a dried vessel was placed bottom up on a bed of coals and then covered with willow and fired. Vessels were fired for the length of time it took for the tide to go out, in and out again (Fienup-Riordan 1975: 15). Joe Friday (1983, p. 5) described pottery making in the Chevak area of the lower Yukon-Kuskokwim delta:

The people he saw making the pots did not put the finished product into the fire right away. It was wrapped inside woven grass for sometime until [sic] and was left hanging on the back end of the house until it hardened by itself. His parents used to be careful that the children don't go near the hanging clay otherwise they were hollered at. It was later exposed to fire . . . the pot that he saw made long time ago was made after lighting a fire and the pot was turned occasionally on all sides by the fire. Each time they would get it closer to the heat and test its stability now and then. They would do this practically all summer and then towards the first snow fall in the fall time, the pot was placed upside down in the porch supported by something. They made a fire underneath and made the heat go inside the pot as a final preparation for the finished product. After this was done, they didn't remove the pot right away but was probably left to cool off. Sometime later it was removed and placed in the hanging grass woven bag.

Finished vessels were sometimes lined with caribou paunch, walrus gut or some other membrane to make them water tight; oil application during firing and intermittently during use likely served a similar purpose (see also, Arnold & Stimmell 1983; Reid 1989: 171). This integration of animal oil, fats, blood and other products at different stages of pottery manufacture could be a challenge in undertaking residue analysis of archaeological ceramic vessels. While some studies have identified marine mammal residues on northern vessels (Farrell et al. 2014; Solazzo and Erhardt 2007; Solazzo et al. 2008), it is possible that the detected residues are from production rather than use. Experimental work could help in differentiating the residues that result from the use of animal products during production versus cooking and processing of animal products in vessels.

A single pottery firing feature is reported from Nelson Island (BIA 1987) (Figure 7.1). Former site residents who visited the location with archaeologists

described how the pottery was fired: “Yes, the fire pit was lined with rocks. Extra rocks were placed in the pit. The shaped object was placed there to dry ... the fire was fueled by wood. Rocks were placed [on the fire], and rimmed with more rocks. That was how the object was heated. When it cooled off the cracks were coated with oil. More oil was used to coat it” (White 1984: 8) (see also Sipary 1984). The firing feature itself was a small, two meter diameter, circular pile of rocks; charcoal and pot sherds were found within the feature. Similar features are noted both in and near house structures at cold season settlement sites (e.g., Giddings and Anderson 1986).

An example of a firing feature was discovered at Cape Espenberg (Figure 7.3) in summer 2010. A shallow dish-like feature less than one meter in diameter was identified outside of a late pre-contact semi-subterranean house in an activity area likely associated with house occupation. The possible pottery firing feature was composed of bright red oxidized sand and an abundance of broken pottery, as well as decomposing clay and ceramic sherds, charcoal fragments and an abundance of burnt bone (Chris and John Darwent, personal communication, 2015). The current lack of known firing features at pre-contact archaeological sites in Alaska is likely influenced by archaeologists simply not looking for such features, as well as difficulty in their identification. Ceramic firing features are likely embedded in other cooking and processing activities and therefore are generalized into broader archaeological features such as “burnt areas” or “kitchens.” It is also possible that pottery firing took place away from cold season residential camps, in short-term logistical camps that are rarely identified or investigated in depth by northern archaeologists.

Perhaps the greatest cost in pottery production is the fuel used for firing ceramics (Rice 1987). While some think that low levels of ceramic production were linked to limited fuel availability in the Arctic (de Laguna 1947; Giddings 1952), others disagree (Oswalt 1955). Harry and Frink (2009; Frink and Harry 2008; Harry et al. 2009a, 2009b) experiment with ceramic production and use but do not explore the fuel requirements for ceramic firing in detail. It is possible that the addition of oil to the wood further increases fuel efficiency, as reported in the contact era in Northwest Alaska (Saario and Kessel 1966; see also, Crawford 2012). Even in treeless regions, driftwood is a seasonally abundant source of fuel available along the coasts and rivers of northern Alaska. But, driftwood may have varied in availability in the past (Alix 2005), and was required for many other tools and for house construction. Use of other materials (bone, dung) for ceramic firing and cooking is also a possibility. Seal oil as fuel for cooking is mentioned in the ethnographic literature (e.g., Burch 1998: 102, 213), but oil is not mentioned as a source of fuel for ceramic firing except when used to soak wood. Analysis of Northwest Alaskan ceramics indicates that these ceramics were fired at low temperatures in relatively uncontrolled conditions (likely open pits). However, scanning electron

microscope analysis of a single sample from St. Lawrence island indicates that pottery was occasionally fired at high enough temperatures for sintering to begin (Anderson and Brown 2007). Additional research on fuel and fuel use in this region, including additional experimentation with the fuel requirements of ceramic firing, are needed to answer this question, along with more archaeological research focused on other aspects of ceramic production. A next step in the study of production could involve using experimental and ethnographic data on firing to develop specific expectations for pottery production features. Existing excavation data could then be revisited to see if any pottery firing features can be identified. Further investigation of “burnt areas” would also be informative.

USE

Ethnographic data from across northern and western Alaska indicates that the primary use of ceramic vessels during the contact era was for cooking rather than food storage or transport. There are numerous ethnographic references to the importance of ceramic vessels in cooking and sustenance in general. For example, Annie Blue mentions that food cooked in clay pots tastes good and does not spoil right away (Blue 1999; see also, Fienup-Riordan 2005: 134; 2007: 49). Blue also says: “I remember the pot was a very important necessity. That’s because we use the pot to feed ourselves therefore keeping us alive. Everyone has a pot. Everyone has a cooking pot. If a person lived without a cooking pot, how will he or she be? Perhaps his stomach will hurt because he will be very hungry. The pot feeds everyone who cooks with it” (Blue 1999: 5). Blue also recounts a story in which talking clay pots bring about abundant animals and successful hunting when requested to do so by people; abundant food keeps the pots full and (by inference) the people happy (Blue 1999).

Ethnographic information about cooking methods are somewhat limited (see Frink and Harry 2008; Spray 2002), although indirect heating is reported. This includes the stone boiling method (e.g., Arnold and Stimmell 1983; Burch 2006: 212, 1998: 102; Fienup-Riordan 2007: 297; Ray 1975: 117; Spencer 1959: 472) or placement of the vessel next to the fire to heat (Fienup-Riordan 2007: 49, 297; Frink and Harry 2008: 111; Giddings 1961: 136; Lucier and VanStone 1992: 5). Some late pre-contact and contact era vessels had lugs or holes for suspending the cooking vessel over a fire, or in the case of smaller lugged vessels, over an oil lamp (Nelson 1983: 202). Jessie Yiasrik Ralph describes using a tripod made out of willow branches to suspend a clay vessel over a fire (Lee et al. 1990: 87). Spencer (1959: 472) mentions that clay vessels were suspended in a net over the fire. According to Joe Friday (1983: 5), “the clay pots were very good for cooking . . . the

food was excellent that was cooked in these pots . . . wood was put underneath the pot to keep it straight and then wood was placed all around and lit. They kept adding wood around the pot until the food inside was cooked.”

The change in pottery form from early round-bottomed and thin-walled vessels in the Paleoeskimo period to flat-bottomed and thick-walled vessels during the Neoeskimo period across Alaska, suggests a general shift from direct to indirect heating, but other evidence (e.g., exterior sooting, thick interior and exterior residues, ethnographic data) points to continued use of Neoeskimo ceramic vessels as direct heating containers. However, Paleoeskimo ceramics from Northwest Alaska are rare and it is not possible at this time to determine with confidence whether early ceramics were indeed round-bottomed. The analyzed Northwest Alaskan assemblage included only fifty-five bases, all of which date to the Neoeskimo period. With the exception of one sherd from the Cape Espenberg site, all dated to the last 1,000 years and the majority of these (forty-two bases, 76 percent of the total) were flat bottomed. Thickness of Neoeskimo ceramics varied from site to site, but overall the Neoeskimo ceramics were much thicker than Paleoeskimo ceramics (Anderson 2011). In an experimental study, Harry and Frink (2009) find that direct heating is advantageous when fuel is limited or there is a need to keep cooking fires small. The persistence of ceramic forms that appear similar to vessels used for indirect heating may be due to local environmental constraints or a continuation of non-ceramic vessel forms. Potential advantages of ceramic vessels over other cooking vessels that could have been used for food processing include the ability to directly heat and boil foods for long periods of time, and economy in production (although procurement costs may offset this). Fat rendering from bone and other meat by-products through boiling or simmering is possible. The ethnographic record indicates that seal oil was typically rendered through other methods (Spray 2002: 39); heat was used to render terrestrial mammal bone and this process could have involved ceramic vessels. Culinary preferences for parboiled foods may also have been a factor in the adoption and persistence of Neoeskimo ceramic vessels (Frink and Harry 2008). Recent residue analyses (Anderson et al. 2017; Farrell et al. 2014; Solazzo and Erhardt 2007; Solazzo et al. 2008) of Alaskan ceramic vessels provides a direct link between ceramics and aquatic resource use as far back as 2485–2341 cal BP. A study of twenty sherds from the Cape Krusenstern site (Anderson et al. 2017) indicates that vessels may have been used for processing freshwater aquatic resources; mixtures of freshwater aquatic, marine aquatic and terrestrial resources are also possible.

Differences in shape and wall thickness in these two time periods may simply reflect alternative cultural traditions and evolutionary trajectories, but could also be related to a shift from direct heating in the Paleoeskimo period to

indirect heating during the Neoeskimo period. Study of vessel performance characteristics link thin walls and a rounded vessel base to direct heating, while thick walls and flat vases are associated with indirect heating practices (Linton 1944; Reid 1989; Sassaman 1995; Skibo et al. 1989). Indirect heating is commonly associated with seed parching and roasting, and also with rendering of fats from meat and bone (Reid 1989). Both approaches to heating may have been used during the Neoeskimo period but particularly in tundra regions where the wood needed for sustained indirect heating was scarce (Harry and Frink 2009). The form of Neoeskimo vessels is particularly well suited for light cooking, or parboiling, of meat, a common cooking practice during the contact era in northern Alaska (Frink and Harry 2008).

Several ethnographic sources mention variation in cooking vessel size related to use. Large cooking vessels were about 7.6–11.4 liters (2–3 gallons), while smaller vessels and cups of unknown size were used for seal oil (Jacobsen, Woldt and Gunther 1977, p. 107; Nelson 1983, p. 201). It is not clear in the original reference whether the smaller vessels were used for *storing* seal oil, or specifically for cooking with seal oil, and how this differed from cooking with the larger vessels. Analysis of fifty Northwest Alaskan ceramic rim sherds identified a wide range of vessel sizes, with some variation in the shape of the vessel opening. The analyzed assemblage was dominated by direct rim sherds, although incurved or restricted rims are present as well, and in larger numbers at interior sites. Rim opening diameters range in size between 25 and 50 cm, with a few outliers at each site measuring between 100 and 200 cm in diameter. Outliers may be the result of measurement error; irregular rim surfaces could introduce error in measurement. Alternatively, outliers may represent large vessels used for non-cooking purposes, for cooking different foods, or for use with a different cooking technique. The spatial distribution of restricted versus direct rim types could be related to different cooking techniques on the coast versus interior and increased wood availability in interior areas. Incurved rims are typically preferred when vessels are used for transporting goods or if heat retention is important (although not necessarily when boiling liquids) (e.g., Rice 1987: 238; see also, Ali 2010; Arnold 2000; Hegmon 2000; Stark 2003). In the Northwest Alaskan study, rim sherds from surface decorated vessels were, on average, greater in diameter and thicker than sherds without surface treatment. The sample size is small, but it is possible that surface treated vessels were designed for different uses than undecorated vessels.

While cooking seems to have been the most common use of ceramic vessels both before and after contact in the eighteenth century, more pronounced ceremonial use of ceramic vessels is mentioned in the Barrow region. On the North Slope, three vessel types are known from the ethnographic period, larger (38–61 cm/15–24" tall) cooking vessels, small (15–20 cm/6–8" tall) cups and flat-bottomed pan-like vessels (Spencer 1959: 471). The ceremonial cups were kept in the ceremonial men's house, or *karigi*, in a special location, and

were used by women of the community to offer fresh water to sea mammal remains. Spencer also mentions ceremonial use of clay pots by interior people of the North Slope. The first caribou meat each year had to be cooked in a clay vessel. These vessels were reportedly obtained through exchange with coastal potters (Spencer 1959: 473). Little is known about non-cooking ceramic use from archaeological contexts. Several bowl-like ceramic vessels are known from Seward Peninsula archaeological sites (Schaaf 1988). Giddings (1952, plate XXV) recovered a cup-like ceramic vessel from the Ahteut site on the Kobuk River. In addition, a single ceramic cup was recovered during recent testing at the Cape Krusenstern Early Western Thule site (Anderson 2011). A large broken ceramic vessel was recovered from an interesting feature during recent excavations at Cape Espenberg. An adult fox and juvenile fox skull were found inside the broken vessel; a small bird skeleton was found inside the mouth of the adult fox skull. The faunal material and bowl was surrounded by ground stone arranged in a ring. Wolf canine pendants were also found in association with the ceramic vessel and faunal material (Chris Darwent, personal communication, 2015).

DISTRIBUTION

In the nineteenth century, Northwest Alaskan ceramic vessels were made for exchange. Pottery from Wales, Buckland and the Selawik River regions were desirable exchange items amongst people from the region and with people from surrounding regions who gathered at several regional trade fairs for exchange (Ballot and Ballot 1987; Burch 1998, 2005; Kugzruk 1987; Lucier and VanStone 1992; Ray 1975). Spencer (1959: 473) discusses production of pottery cooking vessels by people on the coast for trade, with inland peoples for ceremonial use. In an unpublished account, Elsie Kugzruk (1987) comments on the exchange of ceramics from the coast for muskrat hides from the interior of the Seward Peninsula: “The pots were made down there on the coast [near Wales]. After they were made they were brought up here to trade usually with muskrat or some other things that the people needs.” Noatak River people would use clay vessels from the Selawik River and Buckland regions (Giddings 1952; Hall 1970; Lucier and VanStone 1992; Stoney 1900: 40). Before metal vessels were available, Nunamiut people of the interior of northern Alaska reportedly made cooking vessels from clay or salty mud (Campbell et al. 2004: 47; Campbell 1998). Spencer (1959: 470) mentions that in the late nineteenth century, when coastal residents used metal cooking pots for their own cooking needs, pottery was still made in coastal areas in the vicinity of Barrow specifically for inland trade. Wire-repaired flat-bottomed ceramics were found by Irving (Irving 1962: 79) at the Kinyiksukvik site, located in the foothills of the Brooks Range; these ceramics were thought to have been imported from downriver (Lucier and

Vanstone 1992: 8). Lower Tena people of the Tanana River exchanged pottery upriver, at least as far as Big Delta (about 435 miles or 700 kilometers away) (de Laguna 1947: 38; see also, McKennan 1959: 45), while people on Shageluk Slough of the Yukon River exchanged pottery downriver in return for beluga and seal oil (de Laguna 1947, p. 140). Pottery production and use reportedly decreased as metal vessels became available across northern Alaska in the eighteenth century (Campbell et al. 2004; Lucier and VanStone 1992; Ponkratova 2006; Ray 1975; Spencer 1959). Despite this, nineteenth century pottery exchange is reported across northern and western Alaska (de Laguna 194; Fienup-Riordan 2007; Lucier and VanStone 1992; Nelson 1983; Osgood 1940; Spencer 1959; Stefansson 1914; Stoney 1900; VanStone 1954).

While ceramic exchange was fairly common during the contact era, the antiquity of this practice was unknown. I undertook a study of pre-contact ceramic distribution in Northwest Alaska to address questions of social interaction during the late Holocene, focusing on the movement of ceramics as a proxy for social interaction across the region. Neutron activation analysis of 395 pottery cooking vessel fragments from seventeen Northwest Alaskan sites shows that over the last 2,000 years, ceramics were incorporated into intraregional interaction networks. Subsequent expansion of the ceramic sourcing sample size, and analysis of additional clay materials has identified several outlying ceramic source groups that likely represent novel combinations of ceramic raw materials that may or may not have been imported or exchanged from outside Northwest Alaska (Anderson et al. 2016).

Investigation of pottery distribution was limited prior to this most recent work, in part because ceramic use life was thought to be short due to vessel fragility. Results of technological analysis of Northwest Alaskan ceramics indicate, however, that vessel fragility was highly variable and depended in part on the amount of organic temper and firing temperature, as well as depositional context and post-depositional processes. The circulation of vessels across Northwest Alaska suggests that they were sturdier than typically conceptualized by archaeologists. Ethnographic data points to careful use of vessels to prolong vessel life. For example, vessels were transported in grass bags or wrapped in grass mats (de Laguna 1947: 141; Fienup-Riordan 2005: 134). While, in many cases, ceramics have an expedient appearance, vessels were clearly valued and handled carefully to prolong their use life. These practices further reflect the investment of time and resources made by potters, and the value of ceramic vessels to northern hunter-gatherers.

REPAIR, REUSE AND DEPOSITION

While the sourcing study has shown that ceramic vessels were durable enough to circulate long distances, they likely broke frequently during use or

transportation. There are a few references to repaired pottery, further indicating that ceramic vessels were a curated technology. Spencer (1959: 472) mentions that on the North Slope pottery was repaired with the addition of clay, feathers and blood to the broken area; the vessel was then re-fired. Wire-repaired pottery is reported from several contexts in the interior of Northwest and northern Alaska (Irving 1962; Robin Mills, personal communication, 2008). Repaired ceramics were not observed in analysis of 3,772 Northwest Alaskan ceramics. During the contact era, ceramic use life was extended by lining or cushioning vessels with woven grass for protection, particularly during transportation (de Laguna 1947: 141; Fienup-Riordan 2005: 134).

There is surprisingly little information available on the specifics of archaeological ceramic depositional contexts. Ceramics are often recovered from house floor and fill contexts, but no study of within-house ceramic distribution patterns has been undertaken to date. Many pre-1970 excavations conducted in Northwest Alaska retained only house level provenience information for ceramics and other materials, so finer-grained analysis of ceramics in museum collections is not possible. Ceramics are sometimes recovered from surface sites, and in these situations are usually interpreted as vessels abandoned or broken during seasonal or short-term camping activities. The association of ceramics with burials is known from a few contact and pre-contact sites but it is not widely reported. Sinka Toopelook (1988) mentions an older grave marked with an old clay pot; Annie Blue (1999) discusses clay pots at the graves of the abandoned villages of Tangvaneq and Angvaneq. Clay lamps were sometimes used as grave goods or burial markers in the Yukon-Kuskokwim delta region (Broderick and Pratt 2009: 134). A clay vessel was identified at a surface burial found on the northern Seward Peninsula in 2013 (Anderson and Junge 2017) and another burial associated vessel was found during recent work in Kotzebue (Ross Smith, personal communication, 2015). The practice of pottery as a burial good does suggest a greater significance for pottery beyond use as a cooking tool. An in depth review of archaeological literature on burials in northern and western Alaska is needed to further explore links between ceramics and burial practices, and to provide evidence for study of how ceramics may have been incorporated into spiritual, social and ceremonial aspects of past lifeways.

CONCLUSION

This chapter integrates new archaeological information on northwestern Alaskan ceramic production and use with ethnographic data from northern and western Alaska. The goal is to better understand the role of pottery technology in past northern hunter-gatherer lifeways. The use life perspective employed here is helpful in considering how pottery making and use could have been

embedded within other important subsistence tasks and social activities during the pre-contact era. This synthesis provides new insights into the role of ceramics in Northwest Alaskan social life and highlights areas related to pottery production and use that need further investigation. Key findings include:

- Ethnographic data indicates that procurement and production were warm-month activities. This is the same time that women, the presumed primary makers and users of pottery, were very busy with other food-getting, processing and storing tasks. That time was set aside during this peak season for pottery production is a further indication of the importance of ceramics both for cooking and perhaps for exchange and other social interactions during the pre-contact era.
- Ethnographic and archaeological data suggest that local and regional variability in clay, temper material and fuels likely played a role in the development and spread of ceramic technology. Variable clay distribution and fuel meant that potters did not always have direct access to desirable clays or to the wood fuel needed for firing. People likely traded for clay or for completed vessels when required pottery-making raw materials were not readily available.
- Ethnographic data indicates that people had specific clay requirements that were shaped by both environmental and social factors; temper use seems to have been more variable and perhaps more expedient. Temper choice may have been made in relationship to clay characteristics or other factors. The need to embed pottery making in other summer subsistence activities could be a clue as to why temper use and firing techniques were highly variable; women used what was on hand at their pottery production site, which was likely located to facilitate other subsistence activities, rather than specifically for pottery production.
- Ethnographic data on the ceremonial use and discard of vessels provide evidence for the important social roles of ceramic vessels during the contact era. Archaeological data indicate vessels were used predominantly for cooking, but variations in the size and shape of vessels suggest differences in cooking techniques and, perhaps, in vessel use.

Northwest Alaskan pottery vessels were a high investment and curated technology, the production of which took time away from other important subsistence and tool-making tasks. Nevertheless, pottery-making technology was maintained for thousands of years, up into the contact era when commercially made vessels became readily available. Ceramic vessels were important for food processing but had significance beyond this in relationship to exchange networks and other aspects of social life. Frink and Harry (2008; Harry and Frink 2009; Harry et al. 2009a, 2009b) make a similar argument for the interplay of environmental and social factors in the adoption and development of ceramic technology in western Alaska. There is a close link between ceramics and marine mammal oil at several stages in the production and use of

pottery in Northwest Alaska. Perhaps it is this link with marine mammal use that led people to maintain such a high investment technology despite the challenges of making and using pottery in Northwest Alaska. In addition to continued study of ceramic technology itself, more research is needed on pre-contact cooking practices, the context of pottery deposition and ceramic residue analysis to further investigate the potential association between marine and freshwater aquatic resources, ceramic use and the social context of past pottery use in Northwest Alaska.

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EIGHT

AN EXPLORATION OF ARCTIC CERAMIC AND SOAPSTONE COOKWARE TECHNOLOGIES AND FOOD PREPARATION SYSTEMS

Liam Frink and Karen G. Harry

INTRODUCTION

Foragers of the northern North American Arctic are atypical of most hunter-gatherers in that they used direct fire/moist cooking methods nearly exclusively to cook their food. Cooking containers were made of clay in the west and of soapstone in the east, although there were some areas where they commingled. These different container materials reflect two very different technological systems. In this chapter we compare the two systems in terms of their performance characteristics and consider some of the advantages and disadvantages associated with the use of each within the social and economic contexts of their use. Our overall goal is to represent the materials as artifacts that are just a part of a larger system of technologies devoted to subsistence production.

ENVIRONMENTAL SETTING

The Arctic setting is a challenging one for human occupation and, though often thought of as a singular environment, is complex and variable in the availability and kinds of resources present. The climate is characterized by relatively short summers followed by long, dark and often harsh winters. The landscape, though regionally variable, is tundra characterized by low terrestrial plant and animal diversity and a low biomass. Economically important

terrestrial mammals include the musk ox and caribou, and migratory birds can be found seasonally. Key fauna resources for coastal Arctic dwellers included seal, whale and fish.

Access to ocean resources varied seasonally and by location. Much of the coastline is locked up in ice for a majority of the year, a situation that is particularly true in the Arctic Ocean. In that area, the ice pack comes close to the shore and the coastline waters generally stay frozen in the winter. Along the Bering Sea to the west, in contrast, the weather is more moderate and the sea is ice-free for several months of the year. These differing ocean conditions lead to differences in availability of marine mammals. Ringed seal, arguably the most important economic species exploited by coastal Eskimo groups, are abundant along the coasts of north and northwestern Alaska and northern Canada, where the sea ice is close to the shoreline. In western Alaska, where sea ice is seldom found adjacent to the shorelines, seals occur in lower densities but extend uniformly out to sea (Freeman 1984: 39). Rivers too, especially in deltaic tundra regions like the Yukon-Kuskokwim and MacKenzie Deltas, can be seasonally abundant with fish, waterfowl and terrestrial and sea mammals.

Fuel wood is an important resource whose availability also varies both seasonally and between regions. Except for the occasional small shrubs that occur along rivers and watercourses, the tundra is virtually treeless. Thus, in the Arctic the main source of wood is driftwood, most of which comes from the interior subarctic forests of North America and Siberia. Driftwood is particularly scarce in the eastern Arctic, and seldom abundant in the west, where logs are carried down the MacKenzie, Yukon and Kuskokwim rivers to the coasts of western and northwestern Alaska. Native men harvest these heavy and dangerous logs during the spring breakup of the rivers, and opportunistically collect them from the open sea and beaches during the summer. Because of the proximity of these three river systems, the supply of western Arctic driftwood is renewed on an annual basis and, compared to the eastern Arctic, is relatively more abundant (Alix 2004: 85). In the eastern regions, driftwood comes from more distant areas. There, wood originating from North American and Siberian forests is carried into the region by sea ice that has entrapped the logs; these logs are then released with the spring ice melt and deposited onto the beaches. Alix (2004: 84) reports that

the consequences of this long distance ice transport are that logs come mainly as smaller fragments, [and they] have been seasoned in the ice and have lost most of their flexibility. In terms of availability, driftwood is more patchy in the East and its renewal is much less predictable.

Remember too that wood was not only valued for fuel, it was also used for housing and tools. The relative availability of wood in the different regions is reflected in how it was used; in the west houses and many tools were

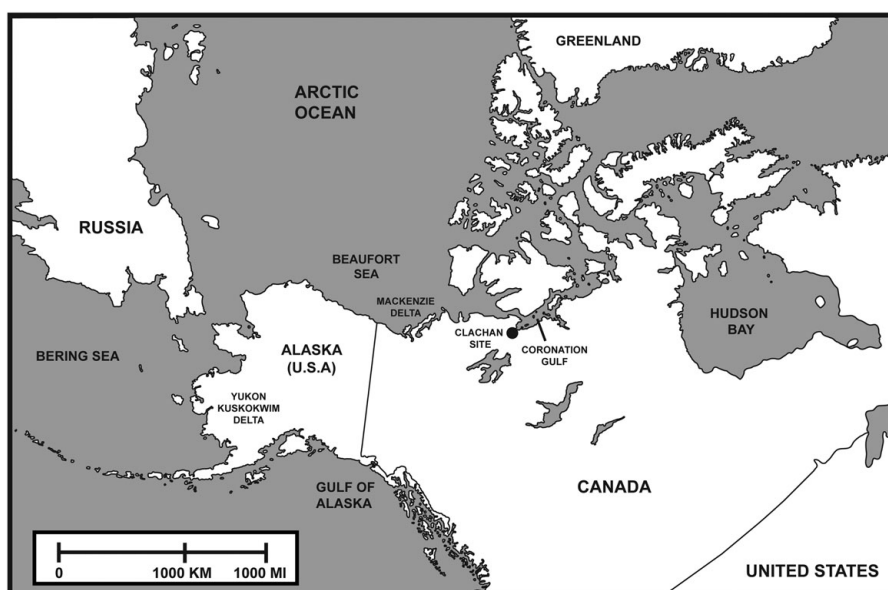
constructed of driftwood, but this is not so in the north and east where houses were constructed from snow blocks or large sea mammal bones. The scarcity and preciousness of wood was acute everywhere in the Arctic, and it is no wonder that Arctic people developed an alternative fuel resource to wood – oil, and in particular, sea mammal oil.

PREHISTORY AND HISTORY

The Arctic culture area encompasses an enormous region that spans several nations and includes numerous archaeological cultures, each of which is referred to by different taxonomic terms depending on the area of research (see Figure 8.1). To facilitate comparison across these regions, Don Dumond (1984) has identified five historical–developmental stages in Arctic prehistory. In the summary that follows, we adopt Dumond’s five stage sequence.¹

Stages I and II (>9000 to 2200 ± 300 BC)

It is unknown when the earliest humans arrived in the Arctic, though they were certainly present in Alaska by 9000–6000 BC. Artifact assemblages indicate that these earliest inhabitants came from Siberia and were hunters of terrestrial mammals. During these stages, occupation of the Arctic was confined to Alaska and Siberia; areas to the east, such as Canada and Greenland, were unoccupied. By about 4000 BC, there is a differentiation between



8.1. Map of northern North American Arctic. Map by Aaron Woods

interior and coastal dwellers. Houses are evident as circular stone rings that are believed to represent the remains of skin-covered tents.

Stage III (2200 ± 300 to 1200 ± 400 BC)

Stage III corresponds to the Arctic Small Tool tradition (ASTt) in the west and Pre-Dorset in the east. During this stage, occupation spreads to Canada and Greenland. The archaeological record suggests that, in Alaska, people had developed a maritime-based economy involving seasonal and year-round hunting, and fishing along the coastline. These populations lived in communities along the shore edge, from where they hunted seal during the spring and fall. They constructed semi-subterranean sod houses for winter use and tents for the spring, summer and fall months. There is no indication that pottery was produced.

By 2000 BC people began moving into the eastern Arctic where they relied on both land (musk ox and caribou) and sea mammals (primarily seal). In Canada, the earliest structures were tents constructed from a framework of willow poles covered by either moss or caribou hides (Dumond 1987: 83). These tents, occupied even in the extremely cold winter months, were heated by interior open fires. Firewood for these tent dwellers was scarce, resulting in the use of muskox and seal bones in addition to wood for fuel. Later in the sequence we see the appearance of small soapstone oil lamps and perhaps pots, though these items were not initially widely used. Pre-Dorset people apparently burned chunks of seal fat on small flat stones as well (Maxwell 1984: 361–2).

Stage IV (1200 ± 400 BC to AD 600 ± 500)

In the Bering Sea area, Stage IV is marked by the appearance of the Norton culture at about 500 BC. Coastal sites increase in frequency and size, reflecting a greater dependence on sea mammals and, possibly later in the sequence, on upriver fishing (Shaw 1983). Locations of some sites suggest year-round sea mammal hunting, likely made possible by the appearance of the seal float. The first ceramic vessels were produced during the Norton period.

In the eastern Arctic, Stage IV is marked by the Dorset culture. During this time people continued to hunt both sea mammals and land mammals, but with an intensified emphasis on sea ice seal hunting. Curiously, the Dorset hunters used harpoons but did not use the bow and arrow, nor is there any indication that they used the seal float. Snow block houses (evidenced by snow knives) were the primary structures used on the winter ice, with tents (often lined internally with stone slabs) used during other seasons. The use of small rectangular and, later, oval soapstone lamps and pots were commonplace and structures typically contained vertical slab-lined central hearths (Dumond

1987). Moreau Maxwell (1984: 365) estimates that most of the soapstone pots would “hardly hold more than a cup of soup.”

Stage V (AD 600 ± 500 to 1800 ± 100)

The beginning of Stage V is marked by the appearance of the Thule culture, which displaces Norton in the west and Dorset in the east. The advent of the historical period marks its end.

The Thule culture appears first in the western region, at around AD 600. Unlike sites associated with the Norton culture, Thule sites occur frequently in riverine as well as in coastal settings. Archaeological data indicate that in this region Thule subsistence consisted of sea mammals (whales in the north and seals along the western coast), land mammals (particularly caribou) and fish (salmon and several other species). Reflecting the relative abundance of wood in the area, winter houses were squarish, semi-subterranean and generally framed with driftwood. However, where driftwood was scarce in northern Alaska, whale bones were often used instead (Lee and Reinhardt 2003). The appearance of the Thule culture is accompanied by a major shift in ceramic technology. Whereas Norton cooking pots tend to be thin walled, well-fired and rounded in shape, Thule pots are thick walled, poorly fired (if fired at all) and have flat bottoms with straight sides (Frink and Harry 2008; Harry and Frink 2009). Like the Norton, the Thule people made pottery lamps, which also were sometimes unfired (Larsen 1950: 180).

A few centuries after their appearance in the western Arctic, the Thule people migrated eastward where they settled in territories previously occupied by the Dorset. Traditional thought held that this migration coincided with a warming trend at about AD 1000, which opened up new areas to migratory whales, caribou and seals (McCartney and Savelle 1985). According to this scenario, the expansion of the Thule culture occurred when Thule hunters followed these prey into newly opened areas, and resulted in the displacement of the Dorset people. Recent radiocarbon evidence, however, is challenging this long-held assumption. More recent evidence suggests the migration occurred some 200 years after the warming trend (Friesen and Arnold 2008), and there was a hiatus between the Dorset and the Thule occupations (Park 1993).

Regardless of the timing or the causes of the Thule migration into Dorset territory, they adopted new practices once there in order to thrive in the region. Like the Dorset people, the Thule living in the eastern Arctic spent much of the year on the sea ice, where they hunted seals and constructed domed snow houses. When not living on the sea ice, however, they constructed round or oval structures supported by whale bones and covered with sod blocks (McGhee 1984). Instead of cooking with clay containers, as their western counterparts did, they adopted the soapstone technology of the Dorset.

The differences seen in the archaeological record between the subsistence and settlement patterns used in the eastern versus the western Arctic are reflected in the ethnographic record. In both areas, inhabitants moved seasonally to exploit various marine, riverine and terrestrial food resources. However, important differences existed between the two regions as well. In the west, settlements were larger and more permanent than they were in the east. All Arctic people moved seasonally, but in the west they tended to occupy settlements for longer periods of time, moving to seasonal fishing and hunting camps. In the west the accumulation of stored food surpluses, particularly dried fish and sea mammal oil, made overwintering in large villages possible. In contrast, coastal groups in the east were more mobile, particularly during the winter months when settlements were moved frequently to take advantage of breathing-hole sealing on the sea ice. (David Morrison [1983] raises the possibility that this historic settlement and subsistence strategy may not be representative of prehistoric adaptations.)

Discussion

The previous summaries of the prehistoric and historic cultures of the Arctic are necessarily broad, and do not capture every nuance and exception. However, several patterns can be discerned. First, there was a general lifestyle and subsistence base that was similar across this extensive coastal Arctic region. This way of life was characterized by a semi-nomadic to semi-sedentary lifeway; a subsistence emphasis on marine mammals and, to a lesser extent, on fish and land mammals; and the use of either pottery or soapstone vessels for lighting, heating and cooking. Compared to the eastern Arctic, the western Arctic had larger and more sedentary communities, more permanent housing, a more reliable subsistence base and – importantly for this study – greater quantities of driftwood. Although archaeologists commonly emphasize the distribution of subsistence resources in shaping Arctic cultures, we propose that the distribution of driftwood also played a substantial role. In the west, where driftwood was relatively more available, wood was used to construct sod houses, make tools and fuel fires. In the east, where wood was scarcer, it was rarely used in housing construction and oil was the primary fuel used for heating and cooking.

Corresponding with these distinctions were differences in the cooking containers used, with pottery being used primarily in the west and soapstone primarily in the east, although a few isolated areas existed where both materials were used (McCullough 1989; Schledermann and McCullough; Simmell and Stromberg 1986). One such area is the Clachan site, a Thule-period site located on the western shore of the Coronation Gulf. Despite being located within 30 km of a soapstone source and in what is generally an aceramic area, the site yielded an abundance of ceramic sherds but only a few fragments of soapstone.

David Morrison (1981) suggests that the use of pottery was made possible by a greater abundance of firewood in the site vicinity than in surrounding areas, and only once this wood was depleted did the residents turn to the use of soapstone for their containers.

ARCTIC COOKING TECHNOLOGIES

Cross-cultural studies demonstrate that worldwide, most non-sedentary hunter-gatherers cook using techniques other than the direct boiling method. Instead, they rely on methods including roasting over an open fire, baking in underground earth ovens or stone boiling. It is easy to understand why these techniques were favored by most hunter-gatherers, since reliance on direct boiling entails the use of durable containers that can be difficult to make and transport for a non-sedentary people.²

Since at least 1000 BC, however, direct boiling has been the dominant cooking method among the non-sedentary people of the Arctic. This pattern is in contrast to the reliance on stone boiling methods by the hunter-gatherers that lived south of the tundra zone. Elsewhere, we have argued that direct boiling was favored in the Arctic because the presence of permafrost, the lengthy, dark winters and a paucity of firewood made it difficult to use other methods such as roasting, cooking in earth ovens and stone boiling (Frink and Harry 2008; Harry and Frink 2009; Frink, Glazer and Harry 2012).

Ethnographic and modern accounts indicate that the preferred cooking method in the Arctic involved only brief parboiling. The mainstay of the coastal Arctic diet was sea mammal meat, a food that is not nutritionally enhanced by cooking. Instead, the opposite is true; the nutritional benefits are maximized when it is eaten raw or only slightly cooked (Draper 1978; Fediuk et al. 2002; Ziker 2002). Thus, for both nutritional reasons as well as cuisine preferences, the traditional Arctic cooking method involved only briefly immersing pieces of meat into hot water, and removing them as soon as they were lightly parboiled (Frink and Harry 2008; Harry and Frink 2009).

Although direct boiling was used throughout the Arctic, there were differences in how this was accomplished. In the west, as already discussed, cooking pots were made of clay whereas in the east they were made of soapstone. These differences in technology involved more than just the raw material used to produce the vessels, however. To explore these differences, the two technologies will be described in detail.

Soapstone Cooking Technology

In central Canada cooking was accomplished through the use of a soapstone cooking container. These small pots might be placed directly over an open fire

of willow, moss or driftwood during the summer (Jenness 1921: 547), but in the winter, when wood resources were buried under snow and cooking took place indoors, the pots were suspended above the flame of a soapstone oil lamp (Balicki 1984; Damas 1984) that likely would have emitted less smoke than an open fire. In addition to cooking pots, driftwood racks for drying meat and/or wet clothing were often suspended over the oil lamps as well (see Figure 8.2).

The stone lamps, which were tended to by and associated with women (Balicki 1984; LeMoine 2003), were the primary light and heat source during the winter. Soapstone oil lamps were shallow, flat-bottomed bowls that held fuel and a wick made of either moss or cotton grass. Sea mammal oil was the most frequently used fuel, though fish and other oils could also be used (Jenness 1921: 547; Balicki 1984: 419). To cook with these lamps, women suspended rectangular, flat-bottomed soapstone cooking pots over the lamp's flame, whose size could be controlled by manipulating the wick with a bone or piece of wood (Boas 1964: 136). To picture this, imagine small birthday candles connected in a row and a woman manipulating the heat and light emitted by adding or subtracting candle flames.

The soapstone used to produce the lamps and bowls was obtained from quarries at soapstone outcroppings (Frink et al. 2012). These outcroppings are found at various areas in the eastern portion of the Arctic, but do not extend



8.2. Inuit woman and child in interior of snow house, Baffin Land (1909). Note the drying rack, the hanging pot (which may actually be wooden) and below the soapstone lamp. (NWT Archives/Archibald Fleming fonds, Accession N-1979-50:0845).



8.3. Reproduced eastern soapstone cooking pot. Photograph by Sophia Phan

farther west than the Coronation Gulf. For individuals living farther west than this location, soapstone could have been obtained only through trade or long-distance travel.

Men were responsible for carving soapstone pots (Balicki 1984; Dumas 1996), a task that was likely fairly labor-intensive and required skill (see Figure 8.3; Frink et al. 2012). Asen Balikci (1970: 21) describes the production process as follows:

Blocks were quarried out with the ice pick, then shaped with the adze. To hollow out the pot, numerous holes were bored close to each other into the solid block with the bow drill. Then the thin walls between the holes were crushed with the adze.

Soapstone vessel production could have been undertaken at any time of the year, and could have been interrupted and resumed quite easily.

Clay Cooking Technology

In the western Arctic, as in the east, the cooking pot and oil lamp were primary components of the household tool kit, though in the former region they were made of clay rather than soapstone. In this area, the oil lamp was used primarily to provide light, with heat being generated from a small wood fire contained within the home's hearth. Cooking was carried out not by suspending the pot over the oil lamp, but by placing the clay pot in the hearth.

The earliest Arctic cooking pots, associated with the Norton culture, are relatively thin walled and hard, and are tempered with organic materials such as fiber or hair. By about AD 1000, however, these vessels were replaced by those associated with the Thule culture. Thule vessels tend to be thick, low-fired, and have coarse pastes that crumble and exfoliate. The softness of the sherds as well as the occasional presence of un-carbonized hair and plant fibers in the pastes suggests that at least some Thule vessels were never fully fired, but merely fire-hardened. To make these porous and underfired vessels capable of holding liquid, seal blood and seal oil were applied to their surfaces (Harry et al. 2009b) (see Figure 8.4).

The forms (flat-bottomed and straight-walled or cylinder-shaped) and textures (coarse with organic tempers and often low-fired or even unfired) of the Arctic pots, are contrary to the expectations scientists have for clay cooking pots.

Cross-culturally, the typical cooking pot is thin walled, fine grained and rounded in shape. These are properties that facilitate the transmission of heat through the vessel wall and make the vessel resistant to damage from thermal shock. Although the Alaska clay pot is less than an ideal cooking vessel, we have argued that its characteristics were necessitated by the harsh environmental conditions under which it was produced. With its constant humidity, cold weather and damp environmental conditions, the Arctic is unequivocally one of the most challenging environments ever encountered for making pottery (Harry et al. 2010). The Arctic clay cooking pot, though less than ideal for its intended function, “worked,” and was likely the only type of pot that could be made under these environmental conditions (see Frink and Harry 2008; Harry et al. 2009a, 2009b for a more detailed discussion of this issue).



8.4. Reproduced western Thule ceramic pot.
Photograph by Sophia Phan

Ethnographic data indicate that, as is the case cross-culturally for most non-specialized pottery production, potting was carried out by the women. Because of the cold and wet weather that characterizes the Arctic, women had only a brief window of opportunity (from June through early August) for making their pots, as this was the only time of the year when the daytime temperatures were high enough to allow the clay bodies to dry (see Frink and Harry 2008). Unfortunately, this brief summer window was also the time when women were at their busiest processing critical summer harvests.

Clays for making pots were undoubtedly easier to obtain than the soapstone used by producers of cooking pots in the east. Clay is widespread in the Arctic, and sourcing studies have demonstrated that a variety of clays were used (Anderson 2011). Nonetheless, not all clays were equally suited for ceramic manufacture, and oral accounts indicate that people were willing to travel some distance to acquire the best clays (Frink and Harry 2008).

Comparison of the Technologies

A comparison of manufacturing and performance characteristics indicates that each technological system had its advantages and disadvantages (see Table 8.1). Soapstone vessels would have been more difficult to manufacture in terms of labor and time. However, because there would have been few or no climatic constraints on their production they could have been made at any time of the year. Pottery production, in contrast, required relatively warm and dry weather, and thus could only have been manufactured during the short summer window when women were already busy with other subsistence

TABLE 8.1. *Comparison of pottery and soapstone technologies.*

Attribute	Soapstone	Pottery
<i>Manufacturing Attribute</i>		
Availability of raw materials	Available at soapstone outcrops; availability depended on distance from outcrop	Clay and tempering materials widely distributed
Ease of manufacture	Required transport of heavy stone and several days of labor to carve stone; could be made any time of the year	Vessels could be quickly manufactured, but window to do so was limited to a short time of the year
Gender of manufacturer	Male	Female
<i>Performance Attribute</i>		
Durability	Moderate	Poor
Portability	Heavy to move, somewhat breakable	Lightweight but extremely friable and easily damaged
Thermal shock resistance	Good	Fair
Heating rate	Slow	Faster than soapstone
Heat retention	Moderate	Poorer than soapstone
<i>Other</i>		
Fuel requirements	Oil; did not substantially impact fuel use since it made use of fuel already being used in the lamp	Wood; required the users to have access to driftwood
Effect on indoor environment	Produced smoke (likely less)	Produced smoke

tasks. Additionally, because one could never know ahead of time if a day would be rainy or sunny, pottery production could not have been scheduled in advance. Instead, women were required to be flexible in their scheduling to meet the demands of the unpredictable weather.

Regardless of the relative effort required to produce ceramic and soapstone vessels, both types of containers appear to have been highly valued. Probably because of the expense involved in obtaining the soapstone and because of the limited periods of time when pottery could be made, both types of vessels were repaired, if at all possible, when damaged (Frink and Harry 2008; Jenness 1946: 62–3, 67).

The ceramic pots would have proved far less durable than the soapstone ones. The use of organic tempers, unprocessed clays and low firing temperatures resulted in clay pots that tended to exfoliate. Cornelius Osgood (1940: 146–9) reported that because of their extreme friability, they historically were stored off the ground to keep them from becoming damp and disintegrating. Further, ethnographic accounts indicate that to keep them from breaking they were packed in skins, or cradled in grass, for transport (De Laguna 1947: 141; Osgood 1940: 146–9).

In contrast to the fragility of the ceramic vessels, soapstone containers would have been far more durable and less susceptible to breakage. However, while less fragile than the ceramic pots, soapstone containers nonetheless can fracture, as we previously experienced during an experiment to reconstruct a soapstone vessel (Frink et al. 2012). Nonetheless, such breakage would be more likely to occur during manufacture than from use. Durability, of course, is an important consideration for non-sedentary people. The ceramic pots would have been difficult to transport between settlements without breaking, whereas such damage to the soapstone vessels would have been rarer. The soapstone pots, however, would have been much heavier to move, a consideration that would have been partially offset by the use of dog sleds.

Experiments have shown that the technological systems also differed in terms of their heating capabilities. We have previously conducted experiments to compare the length of time needed to bring the contents of soapstone and ceramic vessels to a boil. Our experiments demonstrate that when replica containers are suspended over a propane-fueled flame, it takes about half as long to heat the contents of soapstone vessels, as opposed to Alaskan clay cooking pots. Specifically, in our experiments it took an average of twenty minutes for water to boil in soapstone containers, but forty-one minutes in clay cooking pot replicas (Frink et al. 2012). When the ceramic pots were placed directly on a small wood fire, however, the contents came to a boil in an average of fifteen minutes (Harry et al. 2009b). The differences in the time required to heat the contents are reflected in the length of time that the heat is retained; once removed from the heat source, the contents of the soapstone vessels retained their heat far better than did that of the ceramic pots (Frink et al. 2012).

Finally, these two technological systems would have differed in terms of the effects they had on the lives of the Arctic people. A major advantage of the soapstone system is that it did not require the use of wood, an important consideration in the coastal region of central Canada where wood was in particularly short supply. It did, of course, require the use of oil. But, because it was suspended above the oil lamp, which otherwise would have been in use most of the time, it required little or no additional fuel to operate. A second advantage related to the use of soapstone is that, when tended to properly, the lamp generated little or no smoke, an important consideration in the small and poorly ventilated winter dwellings of the eastern Arctic.

DISCUSSION

Prior to the adoption of modern technologies, cooking in the Arctic posed substantial challenges. Many of the cooking methods commonly used by hunter-gatherers, such as stone boiling, roasting directly over the fire or baking in earth ovens, were not viable options. By default, direct boiling was used.

However, even direct boiling had its challenges. The need for a durable container would have created a conundrum for the Arctic people; while most people who direct boil use pottery, environmental conditions made making pots in this area quite challenging. Further, the only types of pots that could be made in this environment were necessarily porous and friable, characteristics that would not have articulated well with their nomadic lifeways. Perhaps, then, it is not surprising that where soapstone was available, it generally was used instead of clay to produce oil lamps and cooking containers. But even producing soapstone containers would have been challenging; acquiring the soapstone required either trade or travel to the soapstone outcroppings, and manufacturing the vessels would have been time consuming. As an indication of the difficulty involved in producing and maintaining the soapstone and clay vessels, it is worth noting that only oil lamps and cooking vessels were made of these materials; all other containers were made of perishable materials such as basketry, hides or sea mammal organs.

Fuel availability was another challenge associated with direct boiling. Wood for fuel was not plentiful in any region, but was particularly scarce in the east. Another problem resulted from the need to cook indoors during the dark and subfreezing winter days. Both the snow-domed houses in the east and the sod houses in the west depended on snow for insulation. Therefore, indoor fires had to be kept to a minimum in order to avoid melting the insides of the houses, which could cause the walls to drip or even collapse (Frink and Harry 2008). Cooking inside, then, essentially required the use of small fires with minimal heat.

In the west, these fires could be fueled by wood. This was made possible by several factors. First, because of the greater amount of driftwood, wood was more abundant there than in the east. Second, because people in the west were relatively less nomadic than those of the east, they could stockpile wood at their primary villages and seasonal settlements. And finally, because the multi-family homes of the west tended to be larger than the smaller, single-family homes used in the east, the smoke generated by the wood-burning fires would have been less of an issue in that area. And, in an area where a lack of soapstone necessitated the use of clay cooking pots, wood-burning fires would have had a distinct advantage over oil-based ones; they could bring the contents of clay cooking pots to a boil nearly three times faster.

The difference between eastern and western cooking technologies is traditionally explained by the differential distribution of soapstone outcroppings. However, although certainly a major factor, we argue that the availability of soapstone may not have been the only one. To understand why some Arctic people used clay cooking pots while others used soapstone ones, we suggest that the full environmental and social contexts of their use must be considered. The different technological systems reflect not only differences in soapstone availability, but also differences in wood abundance, housing sizes and construction materials, settlement patterns, and degree of nomadism.

CONCLUSIONS

Clearly the story of ceramics in the west and soapstone in the east is a complicated one, and a full explanation of the use of these systems is beyond the scope of this chapter. Nevertheless, a consideration of the manufacturing challenges, performance characteristics and use attributes of each of these systems within the social and environmental contexts of Arctic lifeways suggests some answers as to why the two different systems existed. In the west, where fuel was more plentiful, settlement more sedentary and soapstone less accessible, the clay cooking pot offered distinct advantages over the use of soapstone containers. In the east, however, where more nomadic lifestyles prevailed and where fuel was less available, the soapstone technological system offered critical advantages.

Particularly intriguing, and in need of more research, are those areas where both ceramic and soapstone containers co-occur. We suggest that one possibility resulted when both soapstone and wood were readily available. In this instance, the people may have opted to use pottery at their summer camps (i.e., during periods when pottery could be made and wood fires could be used) and soapstone during other seasons (i.e., when oil-based fires were required and when pottery could neither be made nor easily transported between settlements). This suggestion raises the possibility that eastern Thule pottery and soapstone may not have been rival containers, but complementary seasonal cooking technologies. Alternatively, as Morris (1981) has suggested, the use of pottery in these areas may signal cultural identity and the desire by migrating Thule people to retain their traditional practices. If so, the use of pottery may have been confined to the earliest occupations, and the use of soapstone containers adopted only after the local wood sources had been exhausted. However, we suspect that the dichotomy between the functional and cultural explanations is a false one, and that both factors – functional and cultural – likely played a role in the use of the two cooking technologies in these areas.

Also unresolved is why some Thule groups neglected ceramic manufacture altogether, and why there was apparently little trade of soapstone to the west prehistorically. Ethnographically, the people of western Alaska greatly valued the soapstone vessels used by their Copper Inuit neighbors (Stefannson 1914: 27). Substantial trade for soapstone, however, did not occur until the mid-1800s, when trade was stimulated by the desire of easterners for Russian metals. Additional research is needed to understand why soapstone trade to the west was seemingly rare before this time period, and why most Thule people appear to have so quickly abandoned all pottery manufacture when they moved into the eastern Arctic. We hope that issues discussed in this chapter will stimulate additional research into these intriguing questions.

ACKNOWLEDGMENTS

We would like to thank Peter Jordan and Kevin Gibbs for having us participate in their SAA session on northern hunter-gatherers and pottery technology, and for managing this edited book. And thank you to UNLV graduate student Aaron Woods for our map, and UNLV undergraduate Sophia Phan for photos of our pots.

NOTES

- 1 The reader should be aware that, as Don Dumond (1984, 72) notes, “the beginning or ending dates of any one such roughly temporal unit are not necessarily identical in all local regions and that some of the stages do not logically apply at all within certain regions. The estimate of variance that is given for the beginning or end of most stages, for example, 2000 $\pm$ 300 B.C., is not a statement of uncertainty about the dates but rather indicates the variation that the beginning or ending of the stage appears to have in different locations.”
- 2 In an intriguing article, John Speth (2015) has recently challenged the long-held assumption that direct boiling requires the use of non-perishable containers. Instead, he notes that “one can easily and effectively boil in perishable containers made of bark, hide, leaves, [and] even paper and plastic, placed directly on the fire” (Speth 2015, 54). However, he also suggests that because these containers might have been difficult to use and had relatively short use-lives, they were likely replaced by other technologies as reliance on boiling as a food preparation increased.

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NINE

CERAMIC USE BY MIDDLE AND LATE WOODLAND FORAGERS OF THE MARITIME PROVINCES

**Michael Deal, Thomas Farrell, Latonia Hartery,
Alison Harris and Michael Sanders**

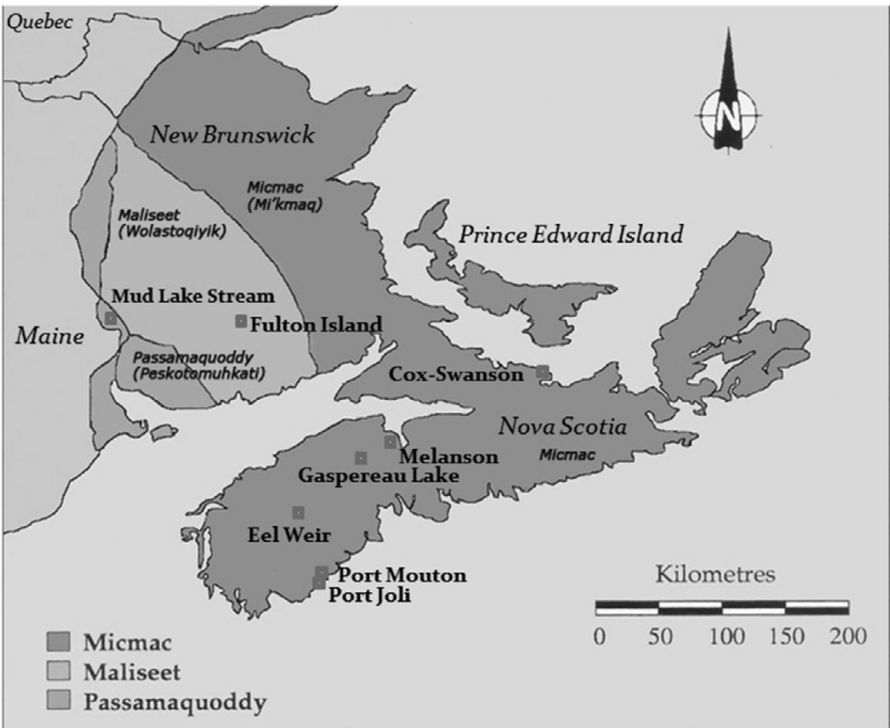
INTRODUCTION

Upon contact with Europeans (ca. AD 1500), the Indigenous peoples of the Maritime Provinces of Canada included three distinct hunter-gatherer groups: the Mi'kmaq (formerly Micmac), Wolastoqiyik (formerly Malecite or Maliseet) and Passamaquoddy (or Peskotomuhkati) (Figure 9.1). The historic Wolastoqiyik and Passamaquoddy are closely related people who differ primarily in their economic adaptation; the Wolastoqiyik are characterized as inland hunters; and the Passamaquoddy as sea-mammal hunters, although the name they give themselves means literally “pollock-spearer” (Erickson 1978: 123). The historic Mi'kmaq are more generalized hunter-gatherers (Bock 1978: 109). The ancestors of these groups began using ceramic vessels during the Woodland period, as early as 3,000 years ago.

James Petersen and David Sanger (1991) divided the Woodland period in Maine and the Maritime Provinces (i.e., the Maritime Peninsula) into seven Ceramic periods that reflect major changes in ceramic technology and decoration over time (Table 9.1). The earliest period (Ceramic period 1) dates from approximately 3050–2150 BP and vessels from this period are only sparsely distributed in the region. According to Petersen and Sanger (1991: 123), “the fact that numerous populations in the northern Maritimes, the Gaspé and the north of the St. Lawrence River never adopted these early ceramics or any subsequent form suggests that there were indeed social and/or environmental

TABLE 9.1. *Ceramic Period subdivisions and temporal equivalents (after Petersen and Sanger 1991:135).*

Ceramic Period Subdivisions	Temporal Equivalents (BP)
Ceramic Period One (Early Woodland)	ca. 3050–2150
Ceramic Period Two (early Middle Woodland)	ca. 2150–1650
Ceramic Period Three (middle Middle Woodland)	ca. 1650–1350
Ceramic Period Four (late Middle Woodland)	ca. 1350–950
Ceramic Period Five (early Late Woodland)	ca. 950–650
Ceramic Period Six (late Late Woodland)	ca. 650–400
Ceramic Period Seven (Contact or Early Historic)	ca. 400–200



9.1. Map of study area indicating approximate boundaries of Indigenous territories at contact, and sites mentioned in text. (base map after Hoffman 1955)

limits to the effective distribution of ceramic technology among widespread hunter-gatherer populations in some portions of the Northeast.” In fact, Early Woodland pottery has been found at fewer than ten sites in the Maritimes and is represented by less than fifty sherds. A recent ceramic residue study by Karine Taché and Oliver Craig (2015: 180) on Early Woodland pottery from the greater Northeast points out that the earliest vessels, the fabric-impressed Vinette 1 pottery, may have been independently invented in the Northeast about 1,200 years before the first evidence of corn (maize) cultivation. Their

research suggests that the initial adoption of pottery may be associated with large seasonal gatherings (e.g., spring anadromous fish runs) and the preparation of aquatic resources (see discussion section). They further suggest that the low quantity and small size of ceramic vessels may reflect the use of these vessels for cooking and consuming fish at feasting events or the preparation of fish oils for exchange (Taché and Craig 2015: 186). The small amount of Early Woodland pottery in the Maritime Provinces appears to have been introduced by the Meadowood people, whose material culture is found sporadically throughout New Brunswick and western Nova Scotia. It is possible that the small amount of pottery found in the area was brought in through trade by a local elite, rather than being produced in the region. This chapter extends the Taché and Craig research into the Middle and Late Woodland periods in the Maritimes and looks at possible changes to regional vessel use over time. Certainly, ceramic vessels became more numerous and larger during the Middle and Late Woodland, which appears to reflect a full-scale adoption of ceramic production and a switch to a more generalized pattern of use.

CERAMIC USE AND SETTLEMENT MOBILITY

Archaeologists have traditionally viewed pottery production as a useful indicator of settled village life (e.g., Arnold 1985). Ceramics were considered too fragile to withstand a mode of life that involved frequent moves, using precarious forms of transportation (e.g., canoes), in areas with unfavorable climates and a lack of resources for pottery production. In other words, ceramics were not suitable to a mobile technology, which is characterized as being limited in quantity and weight, and multipurpose in nature (e.g., Shott 1986: 20). However, as the other chapters in this book illustrate, there were many archaeologically and ethnographically known hunter-gatherer societies that made and used ceramics. This use of ceramics by mobile hunter-gatherers has intrigued archaeologists for some time.

Pottery vessels in the Woodland period in the Maritimes Provinces were made in a limited number of shapes and sizes, with early forms having elliptical bodies with pointed bases, while more spherical-bodied, round-based vessels appear much later in the sequence. A study of nearly complete vessels from the region suggests a typical range in capacity of 5–15 liters (Stapelfeldt 2010a). In a classic paper on North American cooking pots, Ralph Linton (1944: 371–372) associated pointed-based vessels, like those found in the study area, with high settlement mobility and limited variability in the ceramic inventory. By contrast, Linton found the round-based vessels tended to be associated with low mobility and higher assemblage variability. Barbara Mills (1985), in a more recent review of thirty-seven ceramic using groups from throughout North America, notes a greater variation in function for pointed-based vessels,

including cooking, serving, storage, brewing and even use as drum bases. She also points out that round-based vessels are associated with a “more diversified diet which includes extensive reliance on seed crops, but not necessarily on agricultural products” (Mills 1985: 10). This may be significant for the study area, where round-based vessels appear later in the sequence, before the possible introduction of horticulture.

The Maritime Provinces held certain advantages over the more northern areas featured in this volume. The climate was moderate, there was a greater diversity of plant and animal resources and mobility was probably less restricted. Furthermore, the production of ceramics may not have compromised traditional subsistence/settlement patterns, as late summer and fall occupation sites allowed ample time for the production and firing of ceramics. It is likely that there was a wide availability of suitable clays for pottery making (Allain 1984; Owen et al. 2014).

With neighbors to the south (New England) and west (southern Ontario and Quebec) practicing rudimentary horticulture, it is not surprising that the Middle/Late Woodland cultures of the Maritime Provinces made extensive use of wild plant resources. Leonard (1996) suggests a three-stage model of late prehistoric–protohistoric plant use for the region. It begins in the late prehistoric period with a hunting–gathering subsistence strategy, supplemented by the collection of edible berries, seeds, nuts and roots. This much is consistent with existing paleoethnobotanical evidence (Deal 2008). Sometime during the late prehistoric period, plum (*Prunus nigra*) arboriculture and tuber management (i.e., groundnut, *Apios americana*) were introduced from outside the region. This rudimentary form of horticulture prepared them for the adoption of tobacco, and later corn (maize) cultivation. This may have taken place between AD 1350 and 1550, in the few areas suitable for growing corn (Leonard 1996: 185). As the volume of European foodstuffs, including peas, beans, biscuits and prunes, increased, attempts at corn horticulture, along with plum arboriculture, were abandoned. This model is compelling, but more archaeological evidence is needed, especially in areas of possible corn cultivation.

For the hunter–gatherers of this region, the functional advantages of ceramics obviously outweighed the disadvantages of a mobile lifestyle. For example, ceramic vessels provided animal-proof storage facilities for liquids, edible fats and dry goods. Boiling liquids in a ceramic pot, directly on the fire, needs much less attention than heating rocks to boil the same liquids in non-ceramic containers, and it would free the cook for other activities (Arnold 1985: 129; Schiffer and Skibo 1987: 608). Boiling in ceramic containers also expands the range of food resources, since some plant foods are made more digestible and palatable through prolonged heating and others are detoxified and made safe for consumption (Arnold 1985: 135). Furthermore, the desirable juices of meats and shellfish are retained in ceramic cooking vessels (Ikawa-Smith 1976).

The aboriginal inhabitants of the region probably needed very few vessels, since population levels were low and their ceramic requirements could be met with a few multipurpose vessels. Moreover, ethnoarchaeological studies indicate that ceramic vessels are more easily and more quickly made than containers of basketry, wood or stone, and therefore may have been considered more disposable than containers made from these other materials. Ceramic containers may have been rarely transported, but rather cached or abandoned at base camps along with site furniture, such as hearths and anvil stones (see Binford 1979: 264; Schiffer and Skibo 1987: 608). Such a practice has in fact been suggested for the large, non-portable wooden boiling troughs that were reported at frequently used campsites during the Contact period (Spiess 1981).

These groups abandoned the use of ceramic vessels in favor of metal pots during the early Contact period (AD 1500–1600). However, as with paleoethnobotanical and zooarchaeological studies in the region, we can apply a direct historical perspective to pre-Contact culinary traditions and pottery use (Deal 2017). Boiling was the most common food preparation technique recorded by early chroniclers and was probably a continuation of pre-Contact practices. They described meat broths made by boiling pieces of moose, deer, caribou, muskrat, porcupine or dog, as well as various species of fish and bird, and even groundnuts (Denys 1908: 397–398, 422–3; Le Clercq 1910; Lescarbot 1914: 254; Maillard 1758; Trueman 1966: 38–40). In addition, a wide variety of plants were used to season broths and make medicinal teas (Amason et al. 1981).

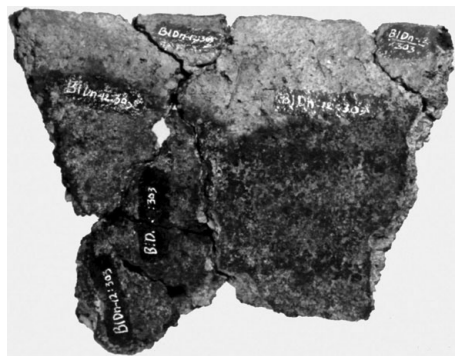
STUDIES OF VESSEL FUNCTION

One avenue for addressing the role of ceramics among the Woodland peoples of the Maritime Provinces is through a better understanding of the nature of aboriginal cooking practices. The most direct line of evidence for this is a functional analysis of the vessels themselves. Various approaches for identifying vessel function have been attempted (e.g., see Hally 1986; Kingery 1981: 463; Mills 1989). Many studies have dealt with the relationships between vessel morphology and function, and in particular, attributes such as vessel size, body shape and rim diameter (e.g., Braun 1980; Hally 1983a; Nelson 1985; Smith 1988). Other studies have concentrated on the physical attributes of the fired clay itself, such as porosity, hardness, thermal shock resistance and variability in tempering materials (e.g., Ericson et al. 1972; Rye 1981; Shepard 1965; Steponaitis 1984). It seems that any vessel design must represent a compromise between technical capabilities and economic needs (Smith 1985: 258). While physical and morphological attributes may inform us of the intended use, or limitations on the use of a given design, they must be regarded as only indirect evidence of vessel use. In a similar manner, ethnographic and ethnohistoric accounts of vessel use can only suggest a function or range of functions for

which a given prehistoric vessel might have been used. Furthermore, provenience may be suggestive of vessel use, but may just as likely be related to secondary vessel use or disposal behavior (Deal and Hagstrum 1995).

Direct evidence of vessel use can be obtained through use-wear and residue analyses. Since both use-wear and residues are records of use events, a single vessel may exhibit a record of more than one such event and more than one function. Such analyses may therefore have a greater potential for identifying the multiple uses of a vessel, as well as distinguishing between primary and secondary use. However, while use-wear can be quite informative when dealing with whole vessels (e.g., Griffiths 1978; Hally 1983b; Kobayashi 1989; Skibo 1992; Skibo and Schiffer 1989), it is extremely difficult to apply to a collection of sherds. This is particularly important in places like the study area, where freeze-thaw conditions inhibit the preservation of whole vessels in archaeological sites. Moreover, much of the wear on sherds is likely to occur in the depositional environment (e.g., Schiffer 1987: 276–278). Of course, residues can also be added after disposal, yet the locations of use residues are more predictable than those of wear patterns.

The presence or absence of organic residues on vessels has been used to distinguish cooking versus non-cooking vessels (Hally 1983a), yet some cooking methods, like parching, may not leave visible residues. Where residues do occur, their chemical analysis should give more provocative results. Residue studies are not a recent development (e.g., Clancy 1961; Lucas and Harris 1962; Von Stokar 1938), but modern technology has improved our ability to detect and identify residues. Organic residues may take the form of carbonized food deposits (Figure 9.2), mineral salts or adhering resins (e.g., Bush and Zubrow 1986; Cackette et al. 1987; Hall et al. 1990; Hastorf and DeNiro 1985; Hill et al. 1989; Morton and Schwarcz 2004; Passi et al. 1981; Skibo and Deal 1995), or the trace constituents of materials absorbed into the porous vessel walls (e.g., Condamin et al. 1976; Dunnell and Hunt 1990; Patrick et al. 1985; Rottlander and Schlichtherle 1983; Skibo 1992). Furthermore, some researchers have utilized microscopy to identify plant and animal remnants preserved in residues, including seeds (Rottlander and Schlichtherle 1978), starch grains (Loy 1994), phytoliths (Pearsall 1989) and the scales, bones and fin rays of fish (Andersen and Malmros 1984). The current project takes advantage of new analytical approaches, along with the use of distinctive biomarkers to identify the sources of individual residues (Evershed 1993; Evershed et al. 2008; Skibo 2013). Following



9.2. Reconstructed rim and neck segment of Vessel 3 from Fulton Island. Note the dark carbonized food deposit on the interior lower rim and neck of vessel.

a review of the original project, we report on the recent analysis of residue samples archived in 1992 and others taken from a single vessel recovered in 2012.

PREVIOUS RESEARCH IN THE MARITIME PROVINCES

Michael Deal and Peter Silk (Research and Productivity Council of New Brunswick) initiated a research program in the 1980s to explore the use of lipid analysis to determine the function of prehistoric ceramic vessels in the Maritime Provinces (Deal 1990; Deal and Silk 1988; Deal et al. 1991). Our attempts to determine the function of prehistoric vessels relied on variability in vessel morphology and physical traits, as well as ethnographic analogs, and the association of plant or animal remains. The presence of organic residues on vessel surfaces was assumed to indicate cooking, but the source of the residues was unknown. We also believed that fats and oils were being absorbed in the porous vessel walls, and that absorbed residues were mixtures representing various liquids cooked or stored in a vessel over its life span.

Reports on residue analysis were just beginning to appear in the literature (e.g., Condamin et al. 1976). In particular, recent advances in the use of gas chromatography/mass spectrometry were making it possible to attempt identification of organic residues based on the survival of lipids, which consist of fatty acids and related compounds derived from edible fats or oils in the residues (e.g., Evershed et al. 1990; Frederickson 1988; Heron and Evershed 1993; Patrick et al. 1985; Rottländer 1990). Fatty acids are important because they occur in different combinations and different proportions in every plant and animal species. They are also known to survive normal cooking temperatures, and for long periods of burial in archaeological sites (Heron et al. 1991).

Our original study included the production and firing of a set of replica bricks from local clays to simulate prehistoric sherds (Deal and Silk 1988). Three bricks were impregnated with fats from beaver, white-tailed deer and yellow perch. These bricks, along with two unaltered control bricks, absorbed residue samples from five prehistoric sherds and soil samples associated with three of the sherds were examined using gas chromatography/mass spectrometry by Peter Silk and See Hua Tan (see [Note 1](#) for technical information of the analyses used in this paper). In two follow-up studies, adhering residues from ten additional ceramic vessels were analyzed, including three more from New Brunswick, along with four modern and prehistoric plant and animal specimens (Deal 1990). In addition, four samples from New Brunswick were subjected to bulk stable isotope analysis by June Morton at McMaster University (Deal et al. 1991; Morton 1989: 81–8). This method was used to separate samples into general dietary categories based on their stable carbon and nitrogen isotope ratios, under the assumption that these ratios reflected the dominant food source in the residues (Morton and Schwarcz 2004).

Chromatogram profiles, cumulative composition plots and various fatty acid ratio values were used in our early attempts to identify the sources of prehistoric residues. Evidence from the control bricks and soil samples indicated that contamination was minimal. Besides the possibility of contamination, identifications were influenced by our understanding of the natural decomposition of the residues through oxidation or hydrolysis. Oxidation is a process whereby fats, and primarily unsaturated fats, are transformed into aldehydes and ketones. Because of this, degraded aquatic fats can be confused with terrestrial fats. However, fatty acids with only one double carbon bond, such as palmitoleic and nervonic are more stable, and are therefore possible indicators of aquatic fats. Fatty acids that survive oxidation undergo hydrolysis. Instead of breaking down the fatty acids, as in oxidation, hydrolysis transforms the acids into a substance called adipocere (Evershed 1992; Mant 1957). Adipocere formation involves considerable shifts in proportions of different fatty acids over time, which makes it difficult to compare fatty acid profiles for modern and prehistoric residues.

In the original New Brunswick study, all of the vessels were recovered from two interior sites: Mud Lake Stream (BkDw-5) in traditional Passamaquoddy territory and Fulton Island (BIDn-12) in traditional Wolastoqiyik territory (Figure 9.1). Five residues were identified with terrestrial mammals, four with fish and one each with non-domesticated (C₃) plants and marine birds (see Table 9.2). In retrospect, three of the residues from Mud Lake Stream appear

TABLE 9.2. Summary of fatty acid (as methyl ester) distribution in fats of samples (percent sample weight) from Fulton Island (FI) and Mud Lake Stream (MLS) vessels (Deal et al. 1991). The more significant values for our interpretation are in italics and underlined.

	Sample#	AS1	AS2	AS3	AS4	AS5	AS6	AS7	AS8
	Site #	BIDn-12	BkDw-5	BkDw-5	BkDw-5	BkDw-5	BkDw-5	BkDw-5	BkDw-5
	Site								
	Name	FI	MLS	MLS	MLS	MLS	MLS	MLS	MLS
	Vessel #	3	105	106a	106b	111	44	97	113
	Fatty Acid								
Caprylic	C8:0	0	nt	nt	2.1	nt	nt	nt	0.1
Capric	C10:0	0	1.7	0.2	1	2.2	0	0	0.2
Lauric	C12:0	2.9	<u>7.2</u>	0.7	<u>6.4</u>	<u>9.9</u>	0	0	0.9
Myristic	C14:0	13	8.6	4.5	10.3	10	0	8	0.6
Palmitic	C16:0	45.9	<u>63.7</u>	<u>72.9</u>	45.1	<u>57.3</u>	56	45	28.6
Stearic	C18:0	32.9	<u>7.4</u>	20.1	27.6	<u>6.7</u>	20	20	<u>65</u>
Arachidic	C20:0	nt	nt	nt	nt	nt	0	4	4.7
Behenic	C22:0	0	0	0	0	0	10	7	0
Lignoceric	C24:0	0	0	0	0	0	4	3	0
Oleic	C18:1	4.8	9.9	1.6	6.1	12.6	10	11	0
Gadoleic	C20:1	<u>0.5</u>	nt	nt	<u>0.2</u>	nt	nt	nt	0
Nervonic	C24:1	0	nt	nt	<u>1.4</u>	nt	nt	nt	0
Linoleic	C18:2	0	1.5	0	0	1.3	0	0	0

to have a plant component, based on relatively high levels of lauric acid, which is common in plant lipids, but normally in low concentrations in mammals and fish (i.e., Vessels 105, 106b and 111).

Vessel number 3 from Fulton Island was the only one that produced a sufficient quantity of adhering residue to permit both GC/MS and stable isotope analyses. The relative amounts of fatty acids for this residue most closely fit those of previously identified prehistoric terrestrial mammals (Deal et al. 1991). The relative amounts of palmitic and oleic acid suggested a moderate degree of degradation. Various other factors tended to support a terrestrial mammal fat component in the residue, including the absence of nervonic acid, relatively high levels of palmitic and stearic acid and stable isotope values favoring a terrestrial mammal or C₃ plant origin. Furthermore, charred muskrat bones were found in association with this vessel.

CURRENT PROJECT

Archived Samples

In the 1990s, there were significant advancements in residue studies, which were spearheaded by researchers in the United Kingdom (Evershed 1993; Evershed et al. 2008). In particular, specific biomarkers (or chemical signatures) were discovered that more accurately identified residues to food groups. Of significance here are the isoprenoid fatty acids (IFAs), phytanic acid and pristanic acid, which occur commonly in marine species, but normally in very low concentrations in terrestrial species (Cramp and Evershed 2014: 323). Another isoprenoid fatty acid, trimethyltridecanoic acid (TMTD) only occurs in aquatic environments when found in association with phytanic and pristanic acids. Another class of compound that indicates a marine origin is ω -(*o*-alkylphenyl)alkanoic (often shortened to alkylphenyl) acids (APAAAs), which are not found in nature, but do occur in heated oils with high concentrations of polyunsaturated (C:20–C:22) fatty acids (Hansel et al. 2004).

In 1992, Michael Deal and Helen Kristmanson established a database for ceramic vessels from southwestern Nova Scotia (e.g., Kristmanson 1992; Kristmanson and Deal 1993). As part of this work, residue samples were removed from eighteen ceramic sherds from the study collection (for site locations see Figure 9.1) and these were archived for future study. In 2014, half of these samples were sent to the University of York for residue analysis using modern acid extraction techniques followed by gas chromatography/mass spectrometry (see Table 9.3 for the components of individual residues). Because of issues of degradation, the utility of interpreting simple lipid percentages is questionable,

TABLE 9.3. Summary of fatty acid (as methyl ester) distribution in fats of samples (percent sample weight of lipids) from nine 1992 archived samples and Gaspereau Lake vessel. The values for lauric (C20:0) and gadoleic (C20:1) are significant to our interpretation and are in *italics* and underlined in the table (PJ=Port Joli; Mel=Melanson; PM=Port Mouton; EW 6=Eel Weir 6; CS=Cox-Swanson; EoD=End of Dyke).

MUN#	92-1	92-3	92-4	92-5	92-6	92-8	92-9	92-14	92-18	2013-1
Site#	AIDf-	BgDb-	AIDf-	BgDb-	AIDf-	9B3oB	BgDb-	BgDb-	DkCq-	BfDd-
Site Name	2	6	1	4	3		4	4	10	24
Vessel	PJ	Mel	PM	Mel	PM	EW 6	Mel	Mel	CS	EofD
	1	11	11	12	15	37	8	4	2	2
Fatty Acid										
Capric	C10:0	-	-	-	-	-	-	-	-	<1
Lauric	C12:0	<u>3.5</u>	<u>8.7</u>	<u><1</u>	<u>7.4</u>	<u>1.9</u>	<u>1.0</u>	<u>8.5</u>	<u>4.7</u>	<u>trace</u>
Myristic	C14:0	8.8	8.2	7.9	8.5	6.4	5.3	9.8	7.9	5
Palmitic	C16:0	38.9	28.4	33.4	32.9	28.9	24.7	25	34.7	41.3
Stearic	C18:0	26.1	10.6	13	12.9	9.5	10.8	11	11.8	12.9
Arachidic	C20:0	trace	<1	1.4	1.1	1.6	1.4	<1	<1	trace
Behenic	C22:0	trace	trace	trace	1.1	<1	1.2	1.7	1.3	trace
Lignoceric	C24:0	0	trace	trace	trace	0	<1	<1	trace	trace
Palmitoleic	C16:1	trace	3	2	3.8	9.4	4.6	3	4.9	11.5
Oleic	C18:1	11	9.2	7.6	12	12.8	18.1	12.1	16.5	16.8
Gadoleic	C20:1	<u>trace</u>	<u>0</u>	<u>1.0</u>	<u>1.8</u>	<u>5.2</u>	<u>1.7</u>	<u>1.5</u>	<u>2.4</u>	<u>trace</u>
Erucic	C22:1	trace	0	trace	<1	2.4	<1	trace	trace	trace

but has been included here for the sake of consistency. It is worth noting that because of different extraction techniques used between studies, these data cannot be directly compared to our 1991 analysis.

Importantly, all of these samples exhibited the presence of aquatic biomarkers (Table 9.4). It may also be significant that all four of the samples from Melanson (BgDb-07) had relatively high levels of lauric acid, suggesting a terrestrial plant or nut component. This site is located on the head of tide for the Gaspereau River, and had access to a wide variety of aquatic and terrestrial resources (Nash et al. 1991). In general, the residue analysis of archived samples indicate a more aquatic-oriented diet for occupants of these Proto-Mi’kmaq sites. It is now our hope to re-analyze the interior Proto-Wolastoqiyik/Passamaquoddy sites from the original study with current methods to determine whether a more terrestrial diet is still indicated.

Gaspereau Lake Vessel

In August of 2012, a nearly complete ceramic vessel, with charred organic deposits on the upper interior wall, was recovered from a small pit feature at the End of Dyke Site (BfDd-24), Gaspereau Lake, Nova Scotia, by a contracting firm in Halifax (Sanders 2014; Figure 9.3). The Gaspereau Lake/Gaspereau

TABLE 9.4. *Presence of aquatic biomarkers in 1992 archived samples and Gaspereau Lake vessel. (X) denotes presence. (–) denotes absence. C(n) denotes acid with carbon chain length n.*

Biomarker:	4,8,12-TMTD Acid	Pristanic Acid	Phytanic Acid	ω-(<i>o</i> -alkylphenyl) Alkanoic acids
MUN Residue Sample #				
1992–1 (Port Joli)	X	X	X	C16, C18, C20
1992–3 (Melanson)	X	X	X	C16, C18(trace)
1992–4 (Port Mouton)	X	X	X	C16, C18, C20, C22
1992–5 (Melanson)	X	X	X	C16, C18, C20, C22
1992–6 (Port Mouton)	X	–	X	C16, C18, C20, C22
1992–8 (Eel Weir)	X	–	X	C16, C18, C20, C22
1992–9 (Melanson)	X	X	X	C18, C20, C22
1992–14 (Melanson)	X	X	X	C18
1992–18 (Cox-Swanson)	X	X	X	C18, C20(trace)
2013–1 (End of Dyke)	X	–	X	C16, C18, C20, C22



9.3. Recovery of Vessel lot 2, Feature 6, End of Dyke site, Gaspereau Lake (2012). Courtesy CRM Group

River Drainage system was one of the most heavily used waterways in the region. The lake provides easy access to many other lakes, while the river is a major source of a small anadromous herring, called gaspereau, or alewife (*Alosa pseudoharengus*). The river also runs close to the major source of White Rock quartzite, which is the dominant chipped stone raw material used on the system.

The contents of the pit (Feature 6) consisted of three elements. The upper element (F-6A) was a layer of dark brown silty loam that measured 12 centimeters thick. This material was indistinguishable from the site's general occupation layer (SL-A/B) and is believed to represent the accumulation of SL-A/B specifically within the confines of the pit. The dark soil of F-6A overlaid and encompassed a concentration of pre-Contact pottery sherds (F-6B). The sherds from this concentration represent a single pot that may have broken *in situ* while seated upright within the pit. Partially penetrated by the sherds at the base of the depression was a thin underlying deposit of light grey sandy silt (F-6C), measuring only about 3 centimeters thick, in the western portion of the depression. Based on its nature, color and restricted distribution, F-6C was identified as a re-deposited mass of scorched subsoil. The base of the depression was delineated by the surface of a fieldstone. Although this stone was flat topped and would have been exposed by the initial excavation of the pit, it lay

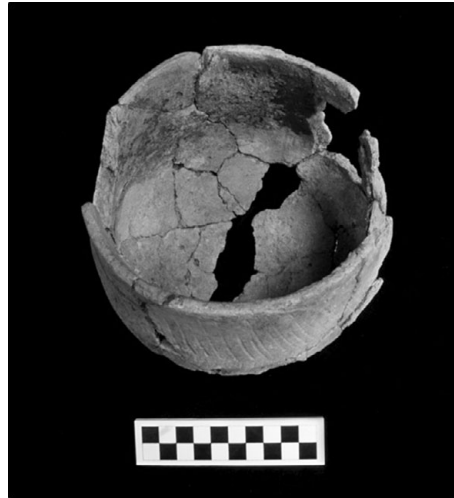
embedded in undisturbed subsoil (SL-C2) and appeared to be an *in situ* component of the subsoil, rather than a placed stone.

The ceramic assemblage recovered from Feature 6 consists of 105 vessel sherds. These sherds appear to represent a single vessel. Preliminary mending of the vessel involved the assembly of thirty-five sherds and yielded one of the most complete pre-Contact pots yet found in the Maritimes (Figure 9.4). The vessel is globular in overall form, with a slight constriction at the rim. Measuring only 140 millimeters high and 150 millimeters wide, its estimated capacity is approximately one liter. The rim of the vessel lacks castellations and its lip is generally rounded. Localized flattening of the surface of the lip is restricted to the high points of the rim, where it appears to represent an effort to perfect rim leveling. The exterior of the vessel, from the rim to within 5 centimeters of the base, is decorated with three horizontal bands of fine, simple (not rockered), pseudo-scallop impressions.

Aside from the array of pseudo-scallop impressions, the vessel surface is smooth, inside and out. The vessel may have been burnished, but not to the point of becoming lustrous. Close examination of broken sherd edges and exfoliated surfaces suggests that, while the sides and rim of the vessel may have been coil-built, the base was hand-molded from a single mass of clay. The clay is tempered sparsely with fine (less than 4 millimeters long) granite particles. The physical integrity exhibited by the surviving sherds suggests that the vessel was fired at a relatively high temperature.

Although it is remarkably small and globular, the Feature 6 vessel exhibits attributes considered characteristic of vessels made during the early part of the Middle Woodland period (ca. 2150–1650 BP). These traits include its grit temper, thin walls, simple rim, smoothed surfaces, pseudo-scallop decoration and high degree of firing (Petersen and Sanger 1991: 131–7). The globular form, more typical of later vessels, may be an indication that the pot was made near the end of the period (ca. 1650 BP).

The Gaspereau Lake vessel is unusual in that it is one of the smallest vessels recovered in the region, with a capacity of about 1 liter. The only smaller vessel reported is a Ceramic Period 4 vessel from the Eisenhower Shell Heap, in Mahone Bay, Nova Scotia (Stapelfeldt 2010b). It has a diameter of 5 centimeters, indicating a capacity of less than 250 milliliters of liquid. The small size



9.4. Interior view of mended vessel from Feature 6, indicating location of charred residue deposit on upper wall near rim (dark patch on upper right of photograph). Courtesy of CRM Group

of this vessel suggests a drinking function, such as an individual portion of an herbal remedy. The Gaspereau Lake vessel appears to have been used on the fire, so it was most likely used for food preparation.

Samples representing both adhering and absorbed residues were sent to the University of York for gas chromatography/mass spectrometry. This technique indicated a number of compounds in the adhering residue (Table 9.4), and in particular, the presence of gadoleic fatty acid, phytanic acid and TMTD suggest an aquatic source. A portion of the same sample was sent to Liverpool University for further testing using a technique called gas chromatography combustion isotope ratio mass spectrometry (GC-c-IRMS), which can determine the relative ratio of light stable isotopes of carbon, hydrogen, nitrogen or oxygen in individual compounds from organic residues (Skibo 2013: 174). This technique provided compound specific isotope data for the Gaspereau Lake Vessel 2 surface residue, giving stable carbon isotope values for palmitic and stearic acids (-31.92 and -34.01 respectively). These values are isotopically light and fall outside of the expected range for most marine and freshwater aquatic sources, and are closer to terrestrial sources. Unfortunately, none of the absorbed residue samples yielded enough lipid for analysis. Overall, the residue adhering to the Gaspereau Lake vessel appears to be aquatic in nature, although, based on the GC-c-IRMS analysis, we cannot rule out a terrestrial mammal component.

Two small sediment samples were taken from the area around the pot and sent to the Paleoethnobotany Laboratory at Memorial University for analysis. They are considered to be from the same depositional level, but are not part of the contents of the vessel. Paleoethnobotanical analysis identified charred seeds of common elderberry (*Sambucus canadensis*) and raspberry or blackberry (*Rubus* sp.), indicating a mid to late summer site occupation at the time the berries were collected (Harris 2013a, b) and the season of vessel use.

Residue samples from food encrustations on the vessel were also prepared for starch and phytolith analysis. Phytoliths are silica “casts” of plant cells formed when silica in ground water is absorbed by the plant’s vascular system. Evaporation and metabolism of this water result in precipitation of the silica in and around the cell walls. These “stone” cells are not as susceptible to deterioration as organic remains, and therefore can last for thousands of years, and in some cases millions of years, as is indicated by their discovery in dinosaur coprolites (Prasad et al. 2005). Phytoliths are distinctive of various levels of plant taxa and can be viewed under a microscope (Pearsall 1989).

Starch grains are microscopic granules that serve as one of the food-storing mechanisms in plants (Piperno and Holst 1998: 765). Like phytoliths, they are differentiable by their shapes, surface features and sizes and are distinctive of specific plant taxa (Reichert 1913). They are found mainly in roots, tubers and seeds (Loy 1994). Positive identification of starch is assisted by the use of light cross-polarization with the “extinction cross” (also known as birefringence) visible on

the grains. Extinction crosses are useful in the identification of starch grains to particular taxa because of their distinct size, shape and extinction character.

Our attempts to recover starch and phytoliths from the two Gaspereau Lake samples represent the first time this technique has been employed at Memorial University, and in Newfoundland in general (see Hartery 2006, 2010). Unfortunately, our tests on the residues produced negative results – no starch or phytoliths were recovered. While this was disappointing at first, it is also positive, since it reinforces the GC/MS results presented earlier that indicate the residue was probably aquatic in nature, as opposed to terrestrial plant.

Organic residue analysis has become a widely used approach in archaeology (Eerkens 2007; Evershed et al. 2008; Farrell et al. 2014; Malainey 2007; Reber and Hart 2008; Taché et al. 2008). There have been several technical refinements since the 1980s, yet identifying the source of an individual residue remains challenging. While there were inherent problems with the interpretation of residues due to the possibility of hydrolysis, oxidation or microbial decay during decomposition, we feel that our tentative identifications from the 1980s may still have some value for understanding past vessel function, and prove to be a useful baseline for future studies. The Gaspereau Lake vessel illustrates the kinds of information that can now be obtained from a single vessel. Although our starch and phytolith analysis had negative results, this method has been used effectively elsewhere (Hart et al. 2007; Lu et al. 2005; Zarillo et al. 2008), and can provide useful evidence on plant use.

DISCUSSION: CHANGING FUNCTIONS OF HUNTER-GATHERER POTTERY IN THE MARITIME PROVINCES

As mentioned briefly already, a recent study by Karine Taché and Oliver Craig (2015) combines carbon and nitrogen isotope and lipid analysis on Early Woodland (Vinette 1) ceramics and residues from the greater Northeast. Bulk carbon and nitrogen analysis on sixty-eight carbonized adhering residue samples suggest some variability, but overall a significant preference for isotopically heavier marine foods at coastal sites over inland sites (Taché and Craig 2015: 181). They indicate that vessels from inland sites may be associated with more complex mixtures of food sources. They also extracted lipids from 112 vessels, which exhibited an array of biomarkers for aquatic foods, such as fish, invertebrates or marine mammals. Their results suggest an association of Early Woodland ceramics with large seasonal gatherings such as seasonal fish runs. This would have involved large-scale processing of the harvested resources (e.g., fish oils), possibly for feasting or exchange (Taché and Craig 1915: 183–6).

If we assume that Early Woodland pottery was more associated with trade and ritual use, what was happening during the succeeding periods when pottery was much more common and widely distributed throughout the

TABLE 9.5. *Tentative identifications of fat components of residues based on gas chromatography/mass spectrometry (GC/MS) and stable isotope (SI) analyses. FI=Fulton Island; MLS=Mud Lake Stream; EOD=End-of-Dyke; PJ=Port Joli; PM=Port Mouton; MN=Melanson; EW6=Eel Weir 6, and C-S=Cox Swanson.*

Sample Source Identification	Period	GC/MS Identification	SI $\delta^{13}\text{C}$	SI $\delta^{15}\text{N}$	SI Identification
New Brunswick (1991)					
Vessel 3, FI	C.P.-2	Terrestrial Mammal	-26.685	6.821	C ₃ Herbivore
Vessel 21, FI	C.P.-2	na	-27.579	8.62	Freshwater Fish /Migratory Bird
Vessel 105, MLS	C.P.-2	Terrestrial Mammal/Plant	na	na	na
Vessel 34, MLS	C.P.-2	na	-27.978	6.697	C ₃ Plant /C ₃ Herbivore
Vessel 111, MLS	C.P.-3	Terrestrial Mammal/Plant	na	na	na
Vessel 113, MLS	C.P.-3	Terrestrial Mammal/Plant	na	na	na
Vessel 56, MLS	C.P.-4	na	-19.017	15.291	Marine Bird
Vessel 106a, MLS	C.P.-4	Terrestrial Mammal	na	na	na
Vessel 106b, MLS	C.P.-4	Aquatic/Plant	na	na	na
Vessel 97, MLS	C.P.-4	Aquatic	na	na	na
Vessel 44, MLS	Undec.	Aquatic	na	na	na
Nova Scotia (2015)			SI $\delta^{13}\text{C}_{16:0}$ (‰)	SI $\delta^{13}\text{C}_{18:0}$ (‰)	
Vessel 2, EoD	CP-2	Aquatic	-31.92	-34.01	Terrestrial Mammal?
Vessel 1, PJ	CP-3	Aquatic/C ₃ Plant	na	na	na
Vessel 11, PM	CP-3	Aquatic	na	na	na
Vessel 15, PM	CP-3	Aquatic/C ₃ Plant	na	na	na
Vessel 4, MN	CP-3	Aquatic/C ₃ Plant	na	na	na
Vessel 37, EW 6	CP-4-5	Aquatic	na	na	na
Vessel 11, MN	CP-4	Aquatic/C ₃ Plant	na	na	na
Vessel 8, MN	CP-4-6	Aquatic/C ₃ Plant	na	na	na
Vessel 12, MN	CP-4-6	Aquatic/C ₃ Plant	na	na	na

region? Although a re-analysis employing current methods is now necessary, our original residue study suggests that vessels were used in a culinary tradition based on preparation of terrestrial mammal products at interior Proto-Wolastoqiyik and Passamaquoddy sites (i.e., Fulton Island and Mud lake Stream). On the other hand, the archived residues from Nova Scotia Proto-Mi'kmaq sites, along with Gaspereau Lake, suggest a more marine vessel use (Table 9.5). A marine signature for a residue from a freshwater lake site,

suggests the cooking of anadromous fish (such as gaspereau) and/or the catadromous American eel (*Anguilla rostrata*), both of which were important to the historic Mi'kmaq diet. Several residues may have also had a terrestrial plant or nut component. Unfortunately, aquatic biomarkers had not been identified until after the original study. However, the findings here are reinforced by a recent study in New Brunswick, in which researchers ran bulk stable isotope samples for residues from twenty-nine ceramic vessels from the Miramichi region, in traditional Mi'kmaq territory; twenty-two from sites along the Saint John River, in traditional Wolastoqiyik territory; and twelve samples from sites in Passamaquoddy Bay, in traditional Passamaquoddy territory (Suttie 2014). Stable isotope values suggest a predominantly marine diet for the Mi'kmaq area and a more terrestrial mammal/freshwater fish/bird diet for the Wolastoqiyik-Passamaquoddy area. When we compare the stable isotope values from the original study, the two Fulton Island samples conform to the Wolastoqiyik-Passamaquoddy range, while the Mud Lake Stream samples are divided.

Additional support is provided directly from human skeletal remains recovered from the Maritime Provinces and northeastern United States. Kelly-Anne Pike's (2013: 161) report of bone collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for fourteen Proto-Mi'kmaq individuals from a Woodland period cemetery at Old Mission Point, in northern New Brunswick, suggests that they relied primarily on marine resources for their dietary protein. Similar results were obtained in a study of the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values from bone collagen of six Proto-Mi'kmaq individuals in Prince Edward Island (Harris et al. 2015) with lower trophic level marine protein contributing predominantly to dietary protein. In New England, Bruce Bourque and Harold Krueger (1994) studied the dietary choices of several populations, including twelve individuals from the Early Woodland cemetery at the Boucher site, Vermont; fourteen individuals from a Late Woodland to Contact period shell midden on Great Moshier Island, Casco Bay; six individuals from the Woodland period Crocker site, North Haven Island; and one from the nearby Parsons site on Vinalhaven Island. The interior Boucher individuals showed Isotope values that consistently demonstrate a terrestrial diet (Bourque and Krueger 1994: 201). By contrast, the Late Woodland to Contact period individuals from coastal sites showed values consistent with a marine fishing diet.

CONCLUSION

Residue studies reported here and elsewhere in the Northeast are producing exciting new insights into the adoption and use of ceramic vessels in the Maritime Provinces. Taché and Craig (2015) have proposed a close connection between ceramics and the use and distribution of aquatic products during the

Early Woodland in the greater Northeast. For the Maritime Provinces, it suggests that the small numbers of vessels may represent vessels used to import fish oil or other products into the region for the local elite (and possibly for feasting or other rituals). Our Middle and Late Woodland period study only included twenty-one residue samples from eight sites, but when combined with the results of other studies, it indicates a trend during the Woodland period from a focus on the use of ceramic vessels for preparing aquatic foods, to use in preparing food mixtures (e.g., stews). This practice probably changed very little up to the historic period. Exploring this notion further will require testing more samples from more sites, and using multiple techniques of analysis. In addition to re-analyzing specimens from the New Brunswick sites up to modern standards, Early Woodland samples from the region should be processed and compared with the results of the Taché and Craig study. We feel that residue analyses will continue to be a valuable approach to the broader interpretation of regional diet and the nature of ceramic vessel use by hunting and gathering peoples.

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NOTE 1

The methods used for GC/MS analysis in the 1980s are outlined by Peter Silk and See Hua Tan (1988). Residue samples were transferred to a 10 ml test tube and boiled with 3–4 ml of methanol for one hour in a hot bath. The methanol was separated and the extraction repeated. The extracts were combined and transesterified by adding one drop of concentrated sulphuric acid and boiled for one hour. The mixture was diluted with an equal volume of 10 percent saline and the methyl esters were extracted twice each with 5 ml of hexane. The extracts were combined and the volume reduced for analysis. The extracts

were analyzed on a 30 m DB225 fused silica capillary column connected to a GC/MS system under the following conditions:

GC: Injector temperature: 250 °C . Helium as carrier gas, maintained at 12 PSI.

Injection was made at 50 °C . After 2 minutes the temperature was raised to 120 °C at 25 °C/min. and programmed at 8 °C/min. to 240 °C and held.

Injection of samples: splitless, 2 ml injected.

MS: Mass spectrometer was operated under the electron impact mode (70 eV).

The data were acquired from 55 to 400 amu at 1 acid second per scan. The minimum detectable amount of fatty acid (as methyl ester) was 1 ng. Standard solutions of various methyl esters were used for comparison.

The 2014 GC/MS analysis was carried out at the University of York, England. Extractions methods used were identical to those described by Farrell et al. (2014). In short, residue samples were extracted and methylated in one step using direct acidified methanol extraction (see Correa-Ascencio and Evershed 2014 for a description of the method).

GC: Samples were analyzed with an Agilent 5975C Inert XL mass-selective detector with quadrupole mass analyzer (Agilent Technologies, Cheshire, UK). The column used was a DB5-ms (5%-phenyl)-methylpolysiloxane model (30 m × 0.32 mm × 0.25 µm; J&W Scientific, Folsom, CA, USA). Injector was splitless and maintained at 300°C. Inlet pressure was constant and set at 26.708 PSI with helium as the carrier gas. The oven program was as follows: temperature held at 50 °C for 2 minutes, then raised 10 °C min until 325 °C. Temperature was held at 325 °C for 15 minutes. Total run time was 44.5 minutes.

MS: Samples were introduced directly into the ion source of the mass spectrometer from the GC column. Ionization energy was set at 70 eV and data was obtained by scanning between m/z 50 and 800.

The GC-c-IRMS analysis of the Gaspereau surface residue sample was carried out at the University of Liverpool, UK, using a Delta V Advantage isotope ratio mass spectrometer (Thermo Fisher, Bremen, Germany) linked to a Trace Ultra gas chromatograph (Thermo Fisher) with a ConFlo IV interface (Cu/Ni combustion reactor held at 1000°C; Thermo Fisher). The methods used were identical to those described by Colonese et al. (2015).

Stable Isotope analyses of residues from Mud Lake Stream and Fulton Island were conducted by June Morton at McMaster University. Her methodology is described in Morton (1989) and Morton and Schwartz (2004). The $\delta^{13}\text{C}$ analyses required 5 mg of residue, while between 15 to 25 mg was required for the $\delta^{15}\text{N}$ analyses. Any samples with adhering plant matter or soil were washed and dried to remove these contaminants. The samples were sealed in evacuated Vycor tubes with cupric oxide and then heated to 900 °C

for two hours to convert the organic matter to CO_2 , N_2 and H_2O . The CO_2 and N_2 were separated on a vacuum line and analyzed on a mass spectrometer (VG-Micromass 602D), and the accuracy was checked by comparison to a standard gelatin.

Botanical specimens were separated from the sediment samples using flotation and microscopy (Harris 2013a, b). A u-shaped device, composed of 0.5 mm copper mesh fastened to an aluminium frame, was used to float the samples. The device was partially immersed in a large volume of water and manually agitated as 250 ml subsamples of sediment were added. The flot, or botanical material, was removed from the device using a metal strainer. The coarse fraction of each sample, collected from the copper mesh, was also removed and both coarse and flot fractions were dried for three days prior to micro- and macroscopic analysis. Each dried fraction was weighed, and then analyzed in full under a microscope ($20\times$ magnification) using established methodology (Pearsall 1989: 110–117).

The methods used for isolating phytoliths and starch from ceramic pot residues followed those outlined in Zorillo et al. (2008). In brief, 0.1 g of each of the two Gaspereau Lake samples were put in two 50 ml centrifuge tubes. These samples were oxidized with the addition of 6 percent hydrogen peroxide (H_2O_2), and in subsequent steps rinsed with deionized water through centrifugation. A heavy-density liquid, sodium polytungstate ($\text{Na}_6(\text{H}_2\text{W}_{12}\text{O}_{40})$), was then added to each sample to induce the separation of the starch and phytoliths from the carbonized residue. Sodium polytungstate was prepared to the specific gravity (sg) appropriate for the microbotanical remains being studied (i.e., sg 1.3 for starch and sg 1.7 for phytoliths; Zorillo et al. 2008). The heavy density liquid, when added to the residue and subjected to centrifugation, causes the microbotanicals to settle to the bottom of the test tube. Once the supernatants in these steps were aspirated, the remaining residues were rinsed and centrifuged with deionized water, to remove any last traces of sodium polytungstate. An aliquot of each residue was then slide mounted with 50/50 glycerin and water.

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PRESTIGE FOODS AND THE ADOPTION OF POTTERY BY SUBARCTIC FORAGERS

**Matthew Boyd, Megan Wady, Andrew Lints,
Clarence Surette and Scott Hamilton**

INTRODUCTION

The archaeological record of the Canadian boreal forest is, on the whole, characterized by long periods of technological continuity, gradual and subtle stylistic change, small and thinly dispersed sites and multigenerational reuse of key places. These perceptions – whether accurate or not – convey a sense of cultural isolation and timelessness to the ancestors of subarctic peoples that is often unjustified with closer scrutiny (Holly 2002). Perhaps the most obvious example of cultural transformation in this region occurred in the last two millennia before European contact, with the spread of Woodland (~100 BC–AD 1700) cultural influence and the adoption of pottery technology.

The function of pottery is an enigma in the ancient Subarctic. On the surface, pottery technology seems inconsistent with the lives of mobile foragers: in contrast to hide or birch bark containers, pottery is relatively heavy, fragile, labor intensive and risky to make, hard to fire in wet and/or cold weather (Frink and Harry 2008), and the raw materials required for their manufacture may at times be difficult to obtain (e.g., during the winter, or in clay-poor regions of the Canadian Shield). Despite these problems, pottery-making knowledge spread rapidly across the south-central boreal forest beginning in the Middle (Initial Shield) Woodland period (~100 BC–AD 1000) and production continued without interruption until European contact. With little or no surviving evidence of organic containers in archaeological sites, pottery has come to be seen

as a defining characteristic of the Woodland tradition in the Subarctic and, by extension, a mundane aspect of food preparation and storage at Woodland habitation sites. Longer site occupancy (Reid and Rajnovich 1985, 1991) or a greater dependence on plant foods (Williamson 2013) have been invoked in order to reconcile the daily use of pottery with its apparent unsuitability for mobile forager life, although few archaeological sites in the region show clear evidence of more sedentary living, or the types of economic changes required to support this behavior, through time. In this chapter, we suggest that pottery was not necessarily manufactured for daily use and, instead, may have been reserved for special communal meals and imbued with meanings different from those given to perishable containers. Importantly, we observe that the foods cooked in pottery often included high-value items such as cultivated plants. As such, these meals and the decorated containers that held them may have played an important role in the symbolism of reciprocity established through feasting and other forms of ritualized consumption.

Ultimately, understanding *why* subarctic peoples adopted pottery in the first place requires detailed knowledge of the function of these vessels – a realm of inquiry that has remained largely inaccessible until the advent of residue studies on northern Woodland materials (Boyd et al. 2006, 2008, 2014; Boyd and Surette 2010). Although food residues have sometimes been regarded as incidental sources of information on diet and other dimensions of human-environmental interaction, in regions such as the Subarctic where organic preservation and cultural stratigraphy are generally poor, residues on stone tools and pottery yield fundamental insight into food choices and artifact function based on stable isotope content, biomarkers, microscopic plant remains and other lines of evidence. In our opinion, the analysis of residues for plant microfossils (e.g., phytoliths, starch granules, pollen) is an especially powerful tool for identifying the procurement of domesticated plants through trade or low-level cultivation. These subtle practices leave little material evidence in the archaeological record, yet are crucial for understanding the emergence of mixed forager economies, and associated technological changes (such as the introduction of pottery), during the Holocene.

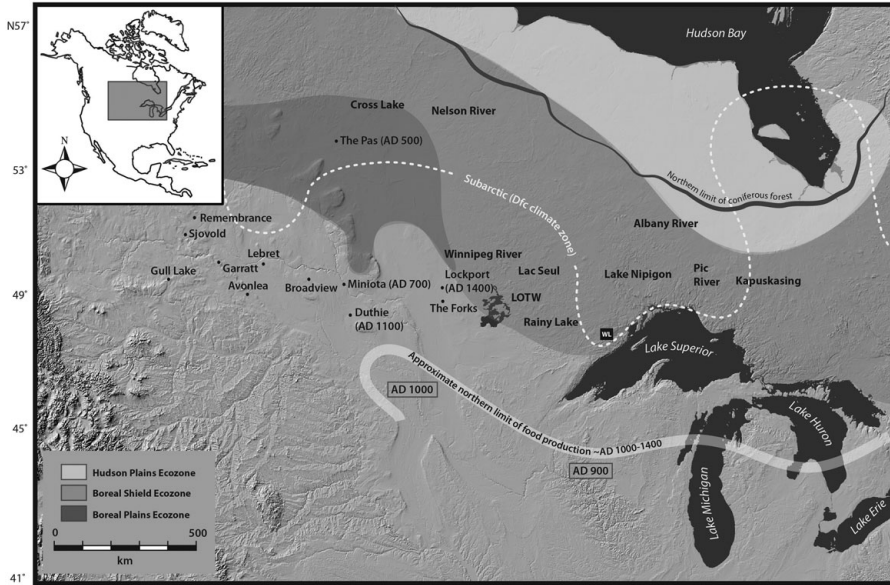
FOOD PRODUCTION, POTTERY AND THE WOODLAND TRADITION IN NORTHERN NORTH AMERICA

The adoption of pottery by subarctic foragers occurred against the dynamic backdrop of the Woodland period and the cultural, dietary and economic changes that it generated. By the time of European contact, Woodland societies were distributed across large portions of eastern North America and varied considerably in terms of social complexity and other attributes. In addition to the first widespread use of pottery, some of the unifying themes of this period

include the expanded use of domesticated food (e.g., the shift towards intensive maize cultivation in some Late Woodland and Mississippian societies), the development of new ceremonial practices (e.g., burial mound construction), larger and perhaps more permanent habitation sites and expanded long distance trade and exchange. While Woodland sites in the boreal forest differ significantly from those in temperate eastern North America, pottery provides the clearest evidence of cultural “connectivity” – and pathways along which goods and information flowed – within the larger Woodland world.

In general, the last two millennia before European contact were characterized by deep social and economic changes across much of eastern North America, culminating in the complex agricultural societies of the Late Woodland and Mississippian traditions. These changes marched in step with the emergence of maize as a dietary staple, and the development of the Three Sisters (maize-bean-squash) crop complex by at least AD 900. The growing importance of maize around this time can clearly be seen in stable carbon isotope values on bone collagen, greater evidence of maize macro remains and other lines of evidence (Adair and Drass 2011; Greenlee 2006; Katzenberg 2006). Despite its eventual importance, little is known about *when* maize first appeared in eastern North America, as well as the distribution and antiquity of *non-intensive* maize cultivation in this large and ecologically diverse region. As a whole, estimates for the first appearance of maize vary considerably, ranging from 300 BC in New York State (Hart et al. 2003), to 60 BC in the Mississippi River Valley (Riley et al. 1994), AD 600 in southern Ontario (Crawford et al. 1997, 2006) and AD 900–1000 in the Central and Northern Plains (Adair and Drass 2011). Some of this variability may reflect real differences in the date of entry, and relative importance, of this plant (e.g., Greenlee 2006), but differences in the archaeological visibility of maize when identified from macro remains, phytoliths, stable carbon isotope ratios and other proxies, may also contribute to the wide range of dates reported across the region.

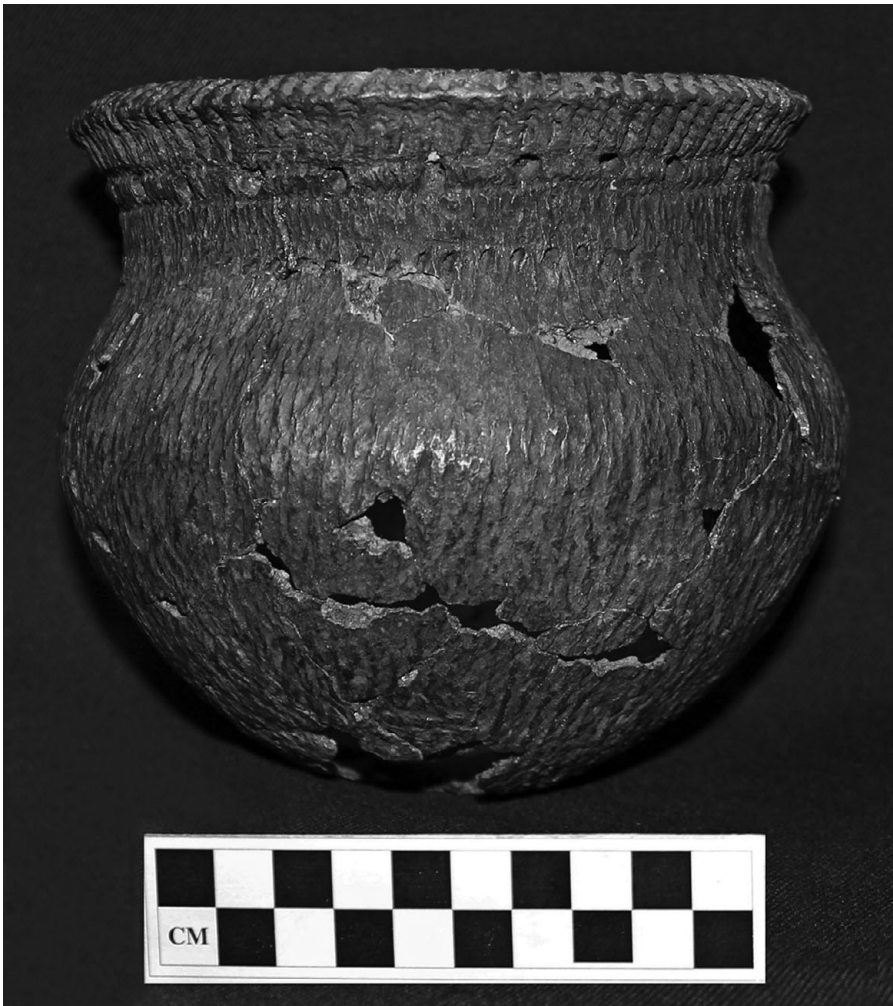
Over time, the changes initiated during the Woodland period were felt beyond the core areas of the Eastern Woodlands, and eventually impacted societies living in the central boreal/subarctic region of North America and other peripheral places (Figure 10.1). The first widespread use of pottery in the southern boreal forest began approximately two thousand years ago with the Laurel phase. Formal and stylistic attributes of Laurel pottery, as well as its age, place it within the Middle Woodland period. In general, Laurel vessels tend to be conoidal, smoothed, grit-tempered and stamped on the exterior rim and neck. Other material remains found in Laurel components include perforated antler harpoon heads, copper tools, burial and effigy mounds in some portions of its geographic range, stemmed/notched projectile points, grinding stones and a range of other lithic and organic artifacts (Anfinson 1979; Arzigian 2008; Budak and Reid 1995). After approximately AD 1000, a variety of pottery–



10.1. Map showing the location of our study, sites/locales in relation to the conventional northern limit of pre-Contact food production, major environmental zones and Whitefish Lake (WL). Dates in boxes are conventional estimates for the first appearance of maize horticulture in the midwest. Dates in parentheses are estimates for maize consumption based on the recovery of *Zea mays* microfossils or macro remains. (Sources: Boyd and Surette 2010, Boyd et al. 2006, 2008, 2014; Lints 2012)

producing, Late Woodland cultural groups inhabited the south-central subarctic until the time of European contact; these include the Blackduck-Kathio, Rainy River, Psinomami (Sandy Lake), and Selkirk phases/complexes.

Although variation does occur from one vessel, site or region to the next, there is often a high level of consistency within subarctic wares with regard to form, size and stylistic treatment.¹ This can be seen, for example, in the nature of Blackduck pottery. This Late (Terminal) Woodland ware extended from northern Wisconsin to the Canadian prairies and northward throughout a vast expanse of the boreal forest of Manitoba and Ontario, and persisted as a distinct type across this large area for at least 500 years (~AD 600–1100). Blackduck vessels are usually globular in shape with constricted necks and short outward-flaring rims, and cord-wrapped paddle-impressed exteriors. Decoration is almost always restricted to the upper portions of the vessel and includes an elaborate mix of cord-wrapped object impressions, comb stamping, deep punctuates and vertical brushing on the surfaces of the lip, rim and neck (Anfinson 2006 in Arzigian 2008; Arzigian 2008; Lenius and Olinyk 1990) (Figure 10.2). Many of the broad characteristics of Blackduck pottery – including its formal and stylistic regularities, and restriction of decorative motifs to the most visible (upper) portions of vessels – are shared by most Middle and Late Woodland wares from the boreal forest. While the specific meaning(s) of subarctic pottery cannot be deduced from these lines of evidence



10.2. Blackduck (Late Woodland) mortuary pot recovered from a burial mound at the Martin-Bird site, Whitefish Lake, Ontario, Canada. Food residue on the interior of this pot – the only surviving remains of what was likely a special meal prepared for the deceased – yielded microfossil evidence of wild rice, maize, common bean and possibly squash.

alone, standardization and an emphasis on conspicuous (upper vessel) decoration/symbolism have been observed in some Woodland and Mississippian ceremonial pots (e.g., Pauketat and Emerson 1991). In a later section, we explore the possibility that pottery was also imbued with special meanings in northern Woodland societies, principally through its connection to feasting.

Subsistence and Diet in the Southern Boreal Forest, 100 BC–AD 1700

Understanding the function of pre-Contact pottery relies heavily on knowledge of food choices and preparation methods. However, due to poor bone

preservation in the boreal forest as well as the lack of attention given to plant remains by archaeologists working in this region, many aspects of the northern Woodland subsistence base and seasonal round are unknown (Wright 2004: 1409). Nevertheless, most researchers assume that Middle and Late Woodland subarctic peoples were mobile, broad-based foragers who subsisted exclusively off wild food resources. Domesticated foods such as maize and squash, despite being consumed (and in some cases grown) historically (Boyd and Surette 2010), are generally thought to have been introduced following European contact (Lovisek et al. 1997; Moodie and Kaye 1969; Wright 2004). This assumption is supported by European accounts dating to the eighteenth and nineteenth centuries which rarely, if ever, record Aboriginal gardens before about the 1820s (Moodie and Kaye 1969; Boyd and Surette 2010). By the mid-1800s, however, gardens of maize, potatoes and other crops were observed in several places from the eastern Canadian prairies to Lake Superior (Boyd and Surette 2010), giving the impression that food production rapidly expanded across this region during the historic period (Moodie and Kaye 1969; Peers 1994: 70). This assumption has been further cemented by over fifty years of archaeological research in the boreal forest – work that has almost universally failed to provide conventional evidence of pre-Contact domesticated plant use (Boyd and Surette 2010). As discussed in this chapter, however, the absence of these foods in the pre-Contact archaeological record is more apparent than real, and probably reflects a combination of poor organic preservation, a lack of archaeobotanical research and the relative insensitivity of macro botanical analysis when it comes to identifying supplemental foods (Boyd and Surette 2010; Boyd et al. 2006, 2008, 2014).

In those sites where faunal remains have survived, a variety of medium- to large-sized ungulate (e.g., moose, elk, caribou and deer), other mammal (e.g., beaver, hare, dog and muskrat), bird, reptile, fish and shellfish taxa have been identified. Of these, fish are assumed to have been particularly important during the warmer months based on site locations and other indirect lines of evidence (Dawson 1981; Mayer-Oakes 1970; Wright 1999). The spring fish spawn may have supported communal (macroband) gatherings which, historically, were important for social reproduction, information and commodity exchange, ritual and planning for the future (Hamilton 1988). Fall fishing camps were also established in order to generate a supply of dried fish for the winter, when large mammal encounter rates were generally low (James 1830: 228–229). Despite the apparent focus on wild foods, the presence of multi-family dwellings and relatively high artifact densities in some locales may also suggest more sedentary habitation and/or increased populations throughout the Middle Woodland (Laurel phase) and Late Woodland periods (Reid and Rajnovich 1985, 1991). This phenomenon has been explained by

intensification of wild rice (*Zizania*) exploitation through time, although direct evidence of this plant tends to be rare in archaeological contexts (Dobbs and Anfinson 1990).

Despite the rarity of wild rice in archaeological sites, many researchers assume that it was a staple of the northern Woodland diet (Boyd et al. 2014; Rajnovich 1984; Valppu 2000). Complicating this issue, however, is the lack of information on when wild rice first appeared across this region, as well as the high degree of lake-to-lake variability in the timing of its colonization. Within lakes in northern Minnesota and northwestern Ontario, for example, the first appearance of *Zizania* ranges from 12,600 cal BP (Birks 1976; Huber 2000) to 6100 cal BP (Boyd et al. 2013) and 1960 cal BP (McAndrews 1969), depending on the lake and its specific hydrological history. Regardless, archaeologists have been eager to attribute major changes in the archaeological record of this region to the history of this plant. For example, the westward and northward spread of the Laurel phase (Middle Woodland) over time has been linked to the dispersal of northern wild rice (*Zizania palustris*) across the Canadian Shield (Buchner 1979: 124; Wright 1999). This idea is largely based on the broad overlap in the distribution of Woodland sites and the modern range of this plant, and the location of large habitation sites beside extant wild rice fields (Rajnovich 1984). In total, direct or indirect evidence of wild rice has been reported from more than sixty-five sites in eastern North America (Surette 2008). Usually, however, this evidence is limited to the recovery of a few seeds, or the presence of enigmatic features interpreted as “ricing jigs” (pits used for hulling wild rice). While most of these sites date to the Woodland period, *Zizania* remains have also been associated with Archaic (Middle Period²) components (Chapman and Shea 1981; Crawford 1982; Hart et al. 2003, 2007; Johnston 1984), suggesting widespread use of this food resource both before, and after, the introduction of the Three Sisters crop system to the Eastern Woodlands.

FOOD RESIDUES AND PLANT MICROFOSSIL ANALYSIS

Our research involves the analysis of plant microfossils from archaeological features and food residues. Unlike macro botanical remains, which almost never survive in subarctic/boreal sites, microfossils such as phytoliths and starch granules preserve well in a range of depositional and archaeological contexts, and provide unique insight into the plant component of paleodietary systems (Boyd and Surette 2010; Boyd et al. 2006, 2008, 2014). When recovered from food residues, furthermore, plant microfossils may help identify the function of artifacts used in food processing and preparation (such as grinding stones and pottery).

Residue Database

This study is based on the analysis of over 380 residue samples from 177 archaeological sites scattered across the southern boreal forest and northern prairies of Canada (Figure 10.1) (see Boyd et al. 2014). These samples derive from all major Middle and Late Woodland, and Plains Woodland, cultures that occupied the region between ~AD 100 and 1500. The majority of our samples were stored in provincial, museum or university repositories and private collections following excavation at various times after roughly the 1940s. Within the total collection, sixty-three samples originate from Woodland components on Whitefish Lake (northwestern Ontario) and were either found in the field by us in 2009 and 2010, or by Kenneth Dawson between 1960 and 1970. In addition to carbonized food encrustations (preserved on pottery), our database includes microfossil assemblages derived from features (hearths, roasting features, occupation layers), and grinding stones and other lithic artifacts from Whitefish Lake and The Forks (Manitoba) (Figure 10.1). Middle Period materials from the latter site are important for assessing the possible introduction of maize into the region before the Woodland period and the adoption of pottery technology.

Microfossil data from some of the sites discussed were previously presented in Boyd and Surette (2010) and Boyd et al. (2006, 2008, 2014), in addition to two masters theses (Lints 2012; Surette 2008). The phytolith/starch results from Whitefish Lake, furthermore, are part of a larger data set from this region reported in Boyd et al. (in preparation). The new contribution of this essay is to use these data as a way of exploring how subarctic foragers used pottery and, by extension, why Woodland pottery may have been adopted in the first place in the boreal forest.

Laboratory Methods

Our plant microfossil extraction method is summarized in Boyd et al. (2014) and involves a combination of acid digestion (for the phytolith fraction only) and sieving using disposable Nitex cloth (for the starch fraction). Identification of plant taxa from the microfossil remains followed Bozarth (1993) and Pearsall et al. (2003) for *Zea mays* ssp. *mays*; Boyd et al. (2008), Boyd and Surette (2010), and Lints (2012) for *Phaseolus vulgaris*; Bozarth (1987) and Lints (2012) for *Cucurbita* sp.; and Surette (2008), Boyd et al. (2013) and Yost and Blinnikov (2011) for *Zizania* spp. Positive identifications were only made for rondel phytoliths if both the base and top were clearly visible. Starch identifications were based on observation under both plane- (PPL) and cross-polarized (XPL) light. A modern starch and phytolith reference collection, comprising over 154 domesticated and wild species, was used to confirm identifications. Approximately 250 phytoliths, and all starch granules, were counted and identified for each archaeological sample. However, only a select portion of the complete data set is discussed here.

DECODING THE FUNCTION(S) OF SUBARCTIC POTTERY

Connection to Cultivated Plant Foods

The northern edge of Woodland cultural influence (including pottery) roughly coincides with the southern margin of the Hudson Plains Ecozone, a vast wetland lying between the Canadian (Boreal) Shield and Hudson and James Bays (Figure 10.1). In general, the northern portions of Manitoba and Ontario have been subject to comparatively little archaeological research, although a continuous human presence on the northern Canadian Shield is evident from the early Holocene until the present day (Hamilton 2004; Wright 1981). Pottery wares recovered in this region are primarily Laurel (Middle Woodland) and Selkirk (Late Woodland) types, and habitation sites tend to be small, thinly scattered and oriented towards major river systems.

In a previous study (Boyd and Surette 2010), we reported recovering maize in Laurel and Late Woodland pottery sherds from three sites located near The Pas, West-Central Manitoba (Figure 10.1). Subsequent work has expanded the distribution of this plant to precontact sites in the vicinity of Cross Lake (54–55° N), and the middle Albany and Nelson Rivers (Figure 10.1). These locales are represented by three sites: GhLh-3, GgLk-2 and EjJe-1 (Howells Lake). Residue samples from an additional twelve sites from the Bloodvein River, Lake Nipigon, Pic River and Kapuskasing regions of northern Ontario also contained maize microfossils and indicate that cultivated plants were consumed across a wide swath of the Canadian Shield, nearly to the limit of the coniferous forest, by at least the Late Woodland period. Furthermore, the apparent ubiquity of maize (up to 60 percent of samples tested [Boyd and Surette 2010]) suggests a close, and multigenerational, association between cultivated plants and Woodland material culture despite the rigors of northern geography and climate.

This relationship can be clearly seen in cooking residues from the Whitefish Lake region (northern Ontario) (Table 10.1, Figure 10.1). Here, microfossils produced by domesticated plants were recovered from 57 percent ($n = 36$) of the carbonized food residue samples, representing six of the total seven archaeological sites studied. A slightly higher proportion (69 percent, $n = 29$) of the samples from the Martin-Bird site (DbJm-5), which dominated our pottery collection, yielded domesticated food remains. Maize, furthermore, was frequently found in more than one form (i.e., both starch and phytolith). Interestingly, wild rice phytoliths were also recovered from most (57 percent) of the food residue samples that produced evidence of maize. Starch from common bean (*Phaseolus* sp.), however, was recovered from only nine (14 percent) of the samples, and only one squash (*Cucurbita* sp.) phytolith was identified. These trends – especially the frequent recovery of maize from both Middle and Late Woodland vessels, the under-representation of common bean

and squash and the tendency to find both maize and wild rice in the same vessel – are echoed across much of the central boreal forest and likely reflect a combination of environmental factors, scheduling behavior and dietary choices (see discussion in Boyd et al. 2014).

While evidence of maize appears in food encrustations on the earliest subarctic pottery (Laurel), this does not necessarily mean that pottery and domesticated plants were adopted simultaneously. Indeed, Late Middle Period components in the boreal forest closely resemble those of the subsequent Woodland period in terms of site settings, subsistence behavior, lithic technology and other fundamental aspects of the archaeological record. In order to test for the presence of domesticated plant foods during the period before the introduction of pottery, we analyzed residues and features from an archaeological site (The Forks) with a well-defined Middle Period component.

The Forks is a large, multi-component, site cluster located at the confluence of the Red and Assiniboine Rivers in southern Manitoba. By virtue of its geological setting, alternating periods of flooding and stabilization produced a thick depositional sequence with numerous, archaeologically-rich paleosols interspersed with sterile fine-grained sediments. Most of the cultural layers are associated with Woodland and Plains Woodland pottery and other materials which, in some areas of the site, overlie a discrete Middle Period component containing various lithic artifacts, hearths and a small faunal assemblage. Radiocarbon ages obtained on terrestrial organics from this component range from 2160 ± 100 BP to 2990 ± 80 BP (Kroker and Goundry 1993; Kroker 1997). Archaeobotanical investigations by one of us (MW) yielded maize-type starch and phytoliths from residue preserved on fire-cracked rock/boiling stones, a lithic artifact (chitho), as well as from a hearth matrix sample and an occupation floor. Gelatinized maize starch, which is produced by heat in the presence of water, was observed in samples of the hearth matrix, on the fire-cracked rock and from the chitho. A radiocarbon date of 2380 ± 30 BP (Beta-355525, 520–390 cal BC) was obtained on a sample of charcoal recovered from the hearth, supporting the Late Middle Period age placement and providing a conservative estimate for the antiquity of maize at the site. It seems, therefore, that at least some populations at the edge of our study area consumed maize shortly before the widespread adoption of pottery.

Technological Perspectives on the Adoption of Pottery

The adoption and/or formal modification of pottery attributes such as vessel shape and wall thickness have sometimes been linked to the heavy exploitation of plant foods such as domesticated cereals (e.g., Braun 1987). This relationship is often attributed to the need for new cooking technologies better suited to making cereals palatable, for leaching toxins out of some plant foods, for

fermentation or for some other practical reason (see Arnold 1988: 128–144; Ikawa-Smith 1976). Because pottery vessels may be heated directly, for example, they facilitate the long cooking times and high temperatures necessary for some domesticated foods; presumably, this would be more difficult to achieve using boiling stones and hide or bark containers. Although we do not deny that pottery can have technological advantages, particularly in sedentary societies that depend heavily on domesticated plant foods, we reject this as the primary explanation for the adoption of pottery by subarctic foragers. This is based primarily on: (1) historical evidence of the widespread use of perishable/organic vessels for cooking plant foods; and (2) examples of maize consumption in precontact societies before the advent of pottery manufacture (see Ellwood et al. 2013; Haas et al. 2013).

The preparation, processing and cooking of wild rice is a labor-intensive endeavour and, in this way, is similar to the demands of domesticated cereals. Furthermore, as a food that requires extensive cooking in order to be palatable, wild rice seems well suited to being cooked in clay pots. However, ethnographic evidence dating to the nineteenth and early twentieth centuries point to extensive use of birch bark containers in order to prepare this food for consumption (Vennum 1988). The permeability of birch bark, in fact, allows a vessel constructed of this material to be suspended above a fire and its water contents heated directly (Vennum 1988: 45), conferring the same advantage usually attributed to pottery. Given the widespread availability of birch bark across the Upper Great Lakes, it is clear why this material was frequently used to fashion cooking vessels. At the same time, however, our analyses of charred food residues indicate that wild rice was also cooked in clay pots across the central boreal forest and northern Plains (Boyd and Surette 2010; Boyd et al., 2014; see also Jenness 1977: 308). Thus, both organic and inorganic containers were likely employed for cooking depending on raw material availability or other factors.

Maize can also be cooked in multiple ways, with or without the use of pottery. Fresh maize ears, for example, were sometimes roasted (Wilson 1987) and dried kernels were popped or ground into flour, depending on the variety. Boiling, which was probably the most common method for cooking stored maize, may also involve the use of boiling stones (rather than directly heating the vessel on or over a fire); recent experimental evidence even indicates that limestone boiling rocks increase the nutrient availability of corn through nixtamalization (Ellwood et al. 2013). With the introduction of common bean (*Phaseolus vulgaris*), however, stone boiling maize with limestone may have been unnecessary as a result of the nutritional complementarity of these foods (Ellwood et al. 2013: 36; Hart et al. 2003). As well, in sedentary populations with maize-dominated diets, pottery cooking vessels may provide a more efficient alternative to stone boiling (Clark et al. 2007; Myers 1989). This scenario, of course, does not apply to the Subarctic, where cultigens were

undoubtedly a minor supplement to a diet based primarily on wild foods (Boyd and Surette 2010), and where other materials such as birch bark would have been available to construct vessels that do not require stone boiling.

There may be some plant foods that benefit more from cooking in clay pots than wild rice or maize. A case has been made, for example, for the connection between common bean and pottery (Ellwood et al. 2013; Skibo and Blinman 1999) because dried beans require more boiling than maize in order to make them palatable (Fritz 2011). Long cooking times are harder to achieve through stone boiling, which requires frequent replacement of hot rocks in order to sustain a high temperature. In this case, vessels composed of clay (or perhaps birch bark) would be more efficient. Similarly, ethnographic evidence from the southern shore of Lake Superior indicates that pottery was preferred for the extraction of fat from oak (*Quercus* spp.) acorns (Skibo 2013). This process, which required simmering the mashed-up acorn meat in water, could be accomplished using boiling stones and organic vessels; however, because some fat was lost when the hot rocks were both immersed and removed from the pot, pottery was better suited to this task (Skibo 2013). We note that residues containing abundant oak starch have not been identified in our collection. This is probably not surprising given the fact that the northern range of oak (e.g., *Quercus macrocarpa* and *Q. rubra*) does not include the subarctic boreal forest (Liu 1990; McWilliams et al. 2002). Furthermore, as discussed in Boyd et al. (2014), domesticated bean is typically rare in boreal archaeological sites.

In summary, there is no clear evidence that pottery vessels would have been *necessary* for food preparation in the Subarctic. On the surface, it seems that perishable vessels would have provided a more readily available, and more transportable, alternative to pottery. Indeed, the major reason often cited for the introduction of pottery – the ability to heat starchy plant foods directly, for sustained periods of time, without the use of stone-boiling – neglects the fact that vessels composed of birch bark can do the same thing, and that the technological advantages of pottery only become evident when cultivated foods dominate the diet and mobility decreases.

Pottery and the Material Culture of Feasting

If pottery was technologically unnecessary, then how do we account for its adoption across such a wide swath of the boreal forest, and its persistence as a cultural trait for almost two millennia? We suggest that the apparent ubiquity of domesticated plants (especially maize) in cooking residues from the Subarctic demonstrates a strong connection between pottery and “special meals” (i.e., feasts) that may have accompanied important ceremonial events, communal gatherings or private rituals of thanksgiving. Cultivated plant foods would have been scarce in the Subarctic. Historically, for example, there were few places in

this region where maize could be reliably grown and so it was often acquired through long-distance trade (Boyd and Surette 2010). Yet, the value of these foods would have been great if they provided nutritional and/or labor advantages over wild plants (see Greaves and Kramer 2014) – this was likely the case with maize due its high carbohydrate content, but not with domesticated bean due to the abundance of wild sources of protein (Boyd et al. 2014). This combination of scarcity and value, then, may have created an incentive for the use of maize as a sacred offering, a currency of exchange, a symbol of individual or group prestige or an element of communal feasts. Of course, rarity is not the only reason why some foods are accorded special statuses; wild rice, for example, was often used as an offering and feasting food in Anishinaabe (Ojibway) society because it was regarded as a sacred gift from the Great Spirit (Vennum 1988).

Feasts are almost universally characterized by the consumption of high-value foods because they provide convenient symbols of wealth and social status, and carry more power as ritual offerings (Hayden 2009, 2014). During the historical period feasting was an important, and multifaceted, institution among the Anishinaabek, and typically occurred in conjunction with funerals and other communal gatherings, “first-fruit” celebrations, childbirth, religious ceremonies (e.g., the *Midewiwin* [Grand Medicine Society]), trading events and as payment for ritual or other services (Hoffman 1891; Vennum 1988; Warren 1984). In the Wyandot (Huron) and Algonquian Feast of the Dead, furthermore, the feast acted as a stage where wealth could be displayed and given away in exchange for prestige and the strengthening of intergroup ties (Tooker 1967; White 2011). As a whole, therefore, feasting was necessary for the maintenance of proper social and spiritual relations, and was closely linked to alliance building, individual aggrandization, communal and private rituals, regulation of the environment and other fundamental facets of life. Consequently, it could have occurred at various times throughout the year, with varying degrees of community participation and significance. To the archaeologist, however, the most “visible” evidence of feasting may be connected to large, seasonal, in-gathering (macroband) sites.

During the early Fur Trade period, large annual (spring and summer) gatherings were an important aspect of Anishinaabe social organization. Typically, these events were located near zones of seasonally-abundant food resources, and enabled large gatherings of families (organized into clans) for an extended period of time (Hamilton 1988; Hickerson 1965). These aggregations were important venues for religious activities, trade, intermarriage and other forms of intergroup integration and socialization (Hamilton 1988: 52) – activities that historically, at least, were closely associated with feasting. Significantly, sites identified as possible in-gathering locales become prominent during the Middle and Late Woodland periods and are characteristically large, with abundant pottery and other domestic refuse, and are usually located near fish spawning grounds and other ecologically-rich habitats (e.g., Arthurs 1986; Dawson 1980, 1987;

Hamilton 1981; Meyer et al. 2013; Reid 1977). This trend towards greater seasonal in-gathering during the Woodland period suggests that the emergence of feasting as a *key* Algonquian institution may have coincided with the introduction of pottery and other aspects of Woodland culture. Indeed, as a highly plastic medium, pottery provides an ideal surface for the projection of important social or ritual meanings. As discussed earlier, subarctic pottery wares often emphasize conspicuous (upper vessel) decoration/symbolism, and show high levels of stylistic similarity across wide regions. These characteristics imply that pottery was “expressive,” and that its use was linked to the collective/communal, rather than individual behavioral realms (Braun 1991). Feasts, of course, are an example of a communal theater in which food and food-related material culture take center stage, and where priority is often placed on enacting and signaling cultural/group affinities and shared beliefs (Smith 1999).

In summary, several lines of evidence point to a functional connection between pottery and feasting in the Subarctic: (1) there is little reason to believe that pottery was necessary for daily food preparation in this region; (2) the formal and stylistic characteristics of northern Woodland pottery fit with its use in communal settings; (3) food residue analyses show a strong connection between pottery and high-value foods such as maize, which in the study area would have been consumed only during special occasions; and (4) the Woodland period, and therefore the introduction of pottery, is associated in many places with more intense intergroup interactions and communal ceremonial activity (e.g., burial mound ceremonialism in the southern portion of the study area). With increased social interaction (including, perhaps, greater flexibility in group membership) may have come an increased motive to signal social identity during communal events (Braun 1991); the highly plastic and “expressive” nature of pottery would have made it ideal for conveying information about social boundaries during feasts.

The image of pottery as an aspect of the material culture of feasting comes into sharper focus in archaeological contexts where ceremonial activities are recorded. At the Martin-Bird site, for example, a miniature Blackduck (Late Woodland) pottery vessel was recovered from a burial mound alongside a human bundle burial and clam shell spoon (Dawson 1987). This vessel (Figure 10.2), which held a thin layer of carbonized food residue indicative of cooking prior to interment, yielded a surprisingly diverse assemblage of plant foods, including wild rice, maize, common bean and possibly squash (Table 10.1). These foods – which were found in other residue samples at the site but rarely in a single pot (Boyd et al. 2014) – and the vessel that contained them were undoubtedly burial offerings and echo the historic Anishinaabe practice of including food with the deceased (Hoffman 1891: 279–280). Such offerings were necessary for the deceased to obtain, *by means of a feast*, a good reception from the spirits (Hoffman 1891: 279–280).

CONCLUSIONS

The adoption of pottery by ancient subarctic foragers is both one of the most striking, as well as enigmatic, material changes documented by archaeologists. This process, which began roughly two millennia before European contact, accompanied the spread of Woodland cultural influence across vast areas of eastern and central North America. In the Subarctic, we argue that pottery was connected to the emergence of feasting as a dominant cultural institution. Based on ethnographic evidence, feasts were necessary in order to maintain proper social and spiritual relations, and were closely linked to alliance building, social status, communal and private rituals, regulation of the environment and other fundamental facets of Algonquian life. A key piece of evidence in support of this argument comes from the frequent recovery of domesticated plant remains, especially maize, in carbonized food encrustations preserved in pottery. In the Subarctic, these foods would have been relatively expensive and therefore reserved for “special” meals. Everyday meals, on the other hand, may have been prepared using organic (birch bark, hide) containers due to their greater availability, ease of transport and durability. Perishable vessels, however, would be virtually invisible to archaeologists due to the characteristically poor preservation of organics in subarctic sites.

This scenario, if correct, has a number of implications for subarctic archaeology. For example, we suggest that residues on pottery may only record a narrow range of dietary decision-making. Secondly, Woodland archaeological sites *without pottery* may exist, and these may be mistakenly attributed to other cultural periods (e.g., Late Middle Period). Finally, as non-utilitarian items linked to feasting, pottery vessels may have been circulated widely, curated and imbued with special social/ceremonial meanings not accorded to other types of material culture.

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APPENDIX

TABLE 10.1. *Carbonized food residue samples from archaeological sites near Whitefish Lake, northwestern Ontario, and select plant microfossil recoveries (X = presence) (Boyd et al. 2014: Table 10.1).*

#	Site Number	Site Name	Cultural Affiliation	<i>Zea mays</i> rondel	<i>Zizania</i> sp. rondel	cf. <i>Cucurbita</i> phytolith	<i>Zea mays</i> starch	<i>Phaseolus vulgaris</i> type starch
1	DbJl-1	East Road	Selkirk					X
2	DbJl-2	Mound Island	Woodland	X	X		X	X
3	DbJl-2	Mound Island	Laurel					
4	DbJl-2	Mound Island	Sandy Lake Plain					
5	DbJl-2	Mound Island	Late Woodland					X
6	DbJl-2	Mound Island	Blackduck					
7	DbJl-3	Perch Point	Blackduck					
8	DbJm-2	McCluskey	Blackduck		X			
9	DbJm-2	McCluskey	Blackduck		X			
10	DbJm-2	McCluskey	Blackduck	X	X		X	
11	DbJm-2	McCluskey	Blackduck					
12	DbJm-2	McCluskey	Late Woodland					
13	DbJm-2	McCluskey	Late Woodland					
14	DbJm-2	McCluskey	Late Woodland	X				
15	DbJm-2	McCluskey	Late Woodland		X			
16	DbJm-2	McCluskey	Blackduck		X			
17	DbJm-2	McCluskey	Late Woodland					
18	DbJm-2	McCluskey	Laurel					
19	DbJm-3	MacGillivray	Laurel	X	X			
20	DbJm-3	MacGillivray	Laurel					
21	DbJm-4	Fisherman's Point	Blackduck	X	X			X
22	DbJm-5	Martin-Bird	Blackduck Mortuary Vessel	X	X		X	X
23	DbJm-5	Martin-Bird	Blackduck (rim)	X	X			X
24	DbJm-5	Martin-Bird	Blackduck (rim)	X	X		X	
25	DbJm-5	Martin-Bird	Blackduck (rim)		X		X	
26	DbJm-5	Martin-Bird	Blackduck complete vessel (FCR feature), rim	X			X	
27	DbJm-5	Martin-Bird	Blackduck complete vessel (FCR feature), body				X	
28	DbJm-5	Martin-Bird	Blackduck (rim)	X			X	
29	DbJm-5	Martin-Bird	Blackduck (rim)	X	X			

#	Site Number	Site Name	Cultural Affiliation	<i>Zea</i> <i>mays</i> rondel	<i>Zizania</i> sp. rondel	cf. <i>Cucurbita</i> phytolith	<i>Zea</i> <i>mays</i> starch	<i>Phaseolus</i> <i>vulgaris</i> type starch
30	DbJm-5	Martin-Bird	Blackduck/Laurel transitional					
31	DbJm-5	Martin-Bird	Brainerd Parallel Grooved					
32	DbJm-5	Martin-Bird	Kathio Series (rim)	X	X			
33	DbJm-5	Martin-Bird	Late Woodland	X		X	X	X
34	DbJm-5	Martin-Bird	Late Woodland				X	
35	DbJm-5	Martin-Bird	Late Woodland (body)	X				
36	DbJm-5	Martin-Bird	Late Woodland (body)	X	X		X	
37	DbJm-5	Martin-Bird	Late Woodland (body)				X	
38	DbJm-5	Martin-Bird	Late Woodland (body)	X			X	
39	DbJm-5	Martin-Bird	Late Woodland (body)				X	
40	DbJm-5	Martin-Bird	Late Woodland (body)					
41	DbJm-5	Martin-Bird	Late Woodland (body)	X	X			X
42	DbJm-5	Martin-Bird	Late Woodland (body)	X	X		X	
43	DbJm-5	Martin-Bird	Late Woodland (body)					
44	DbJm-5	Martin-Bird	Late Woodland (body)	X				
45	DbJm-5	Martin-Bird	Late Woodland fabric impressed (body)	X	X		X	
46	DbJm-5	Martin-Bird	Late Woodland refit (body, n=4)	X	X		X	
47	DbJm-5	Martin-Bird	Laurel (body), wide CWT impressions	X	X		X	
48	DbJm-5	Martin-Bird	Middle Woodland? net- impressed sherd	X				
49	DbJm-5	Martin-Bird	Selkirk (Clearwater Lake Punctate) rim/neck	X	X		X	X
50	DbJm-5	Martin-Bird	Selkirk (neck)					
51	DbJm-5	Martin-Bird	Selkirk (neck)	X			X	

(continued)

TABLE 10.1. (*continued*)

#	Site Number	Site Name	Cultural Affiliation	<i>Zea</i> <i>mays</i> rondel	<i>Zizania</i> sp. rondel	cf. <i>Cucurbita</i> phytolith	<i>Zea</i> <i>mays</i> starch	<i>Phaseolus</i> <i>vulgaris</i> type starch
52	DbJm-5	Martin-Bird	Selkirk (rim)	X	X		X	
53	DbJm-5	Martin-Bird	Duck Bay (rim)	X	X		X	
54	DbJm-5	Martin-Bird	Selkirk/Rainy River	X	X		X	
55	DbJm-5	Martin-Bird	Indet. fabric impressed (surface find)					
56	DbJm-5	Martin-Bird	Late Woodland (rim/neck), trailed	X			X	
57	DbJm-5	Martin-Bird	Blackduck					
58	DbJm-5	Martin-Bird	Blackduck?	X				
59	DbJm-5	Martin-Bird	Late Woodland					
60	DbJm-5	Martin-Bird	Late Woodland		X			
61	DbJm-5	Martin-Bird	Laurel					
62	DbJm-5	Martin-Bird	Laurel?		X			
63	DbJm-5	Martin-Bird	Sandy Lake					

NOTES

- 1 As shown by Taché (2005), however, variability due to stylistic change through time or exchange and circulation of finished containers may be hidden unless fine-grained pottery studies are undertaken at the site level. Few sites of this sort have been conducted in the boreal forest.
- 2 Although “Archaic” is widely used as a cultural-chronological term by North American archaeologists, we prefer to use more neutral terminology (“Middle Period”) due to the perception of the former as pejorative by descendant populations. Thus, in this paper, “Late Middle Period” is synonymous with “Late Archaic,” etc.

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ELEVEN

USE OF CERAMIC TECHNOLOGIES BY CIRCUMPOLAR HUNTER-GATHERERS

Current Progress and Future Research Prospects

Brian Hayden

INTRODUCTION

One of the earliest appearances of pottery is in northern regions among hunting/gathering/fishing peoples of the Late Pleistocene, far from the temperate climes of early agriculturalists. As the editors and many contributors have made abundantly clear, *any* adoption of pottery in northern contexts is unexpected given the constraints and difficulties of pottery production and use in these environments. As some of the earliest hearths of pottery innovation, these occurrences simply seem baffling given the long standing assumptions in archaeology about the origins of pottery. Thus, it seems that there must have been some powerful motivations capable of overriding all the constraints and problems involved in pottery production and use in the north. What could those motivations have been?

The origin of pottery, like the origin of domestication and the origin of metals, is one of those pivotal technological changes that transformed the world, and maybe they are distantly related. For over two million years, there was no sign of pottery, metals or domestication. Yet in the comparatively short space of about 10,000 years at the end of the Pleistocene, they had all appeared in the world, in multiple geographical areas, and seemingly independently. Yet, the penecontemporaneity of these ceramic developments in a number of different places, particularly in the north – often with remarkable similarities in shapes, sizes, pastes and thickness in the form of similar conical jars found in the Baltic,

Siberia, Japan and northern North America – begs the question of how they could have been related. Some researchers see no relationship, or are mute about possible connections. They argue against any underlying principles or unifying causal factors, as represented in this collection by Vetrov and Hommel. The emergence of the same technology in different areas is portrayed as emerging under different causalities with contemporaneity and morphological similarities apparently only a coincidence. But, as the preceding chapters document, early pottery appears at strikingly similar time periods in Siberia (c. 14,000 BP or earlier) and in Japan (by 16,850 BP). We should remember that it also appears to have emerged independently in China (around 18,000 BP; Yuan 2002), the Near East (by 10,000 BP, Gibbs 2015), Africa (around 8500 BP, Garcea 2006) and coastal Amazon (c. 7000 BP, Roosevelt 1995), many of these occurrences being among hunter/gatherer/fishers as well.

So, leaving aside the issue of possible connections with domestication and metals, what are the possible explanations for the apparent independent invention and later adoption of pottery in the north? In my compass, they can be broken down into several basic themes. These are:

- *Diffusion of ceramic knowledge.* This assumes: A) a development in a core area as adaptation for survival (such as it may have been in the high arctic as argued by Admiraal and Knecht, and Frink and Harry) followed by diffusion throughout the world, including into areas where pottery was not critical for survival; or B) deep diffusion of more basic technologies such as the use of nets for fishing or the use of heated rocks for lipid extraction which probably only began in the Upper Paleolithic, but spread to many areas during the Mesolithic, followed by multiple independent developments of pottery technology to improve the effectiveness and efficiency of lipid extraction. The problem with the first diffusion explanation is that pottery has not been shown to be critical for survival in any of the study areas. Indeed, how did groups survive without ceramics before 3000 BP in the American Arctic? Pottery actually arrives quite late in areas like the Arctic where its survival value might be argued to be critical. The second scenario for deep diffusion connected to lipid extraction via heated rocks in large parts of the world seems more plausible. After all, microlithic technology (as part of bow and arrow technology) spread remarkably rapidly throughout the world during the same time period. Thus, basic technological concepts such as stone boiling and lipid extraction appear to have been very diffusible over many continents.
- *Genetic improvements in intelligence.* The argument that human intelligence only became developed enough to invent pottery after 20,000 years ago or so seems belied by arguments for the emergence of full *sapiens* mental abilities 100,000 or 200,000 years ago. In addition, there are good indications that Neandertals were fully aware of the ceramic properties of clays and used them for cooking (Villeneuve 1906: 55–6). If intelligence was not the sufficient condition for

inventing or adopting pottery, what were the new conditions that made it an optimal solution for processing food resources?

- *Achievement of critical masses of information.* This explanation for the emergence of pottery technology relies on the idea that information preconditions are required in order to advance to technologically more complex innovations. Thus, high temperature firing of ceramics had to be developed before ores could be smelted; metallurgy was needed before internal combustion engines could be invented; and electrical systems had to be in place before computers could exist. In Braidwood's terms, domestication – and by extension pottery – happened when cultures were ready for it. But the informational or technological preconditions of developing ceramics are not evident, and the chapters in this volume have repeatedly demonstrated that pottery developed or was adopted in the north under adverse conditions, while basic ceramic technology was known since much earlier times in the Paleolithic. We are constantly left wondering what people in many of these areas did before pottery appeared on the scene if it provided so many advantages for basic subsistence, especially if knowledge of the characteristics of fired clay existed 23,000 or 50,000 or even 100,000 years ago.
- *Common responses to new social contexts and demands.* A fourth type of explanation for the widespread development and adoption of pottery in the north is that socioeconomic complexity (involving feasting and the sociopolitical benefits that it could provide) is the most obvious new social development in the Eurasian Upper Paleolithic and Mesolithic world. While Uchiyama, and Boyd et al., among others support such a view, Vetrov and Hommel argue for the development of pottery in Siberia well before social complexity or feasts.

Thus, no single explanation for the widespread appearance of pottery in the north is without its flaws. Should we therefore abandon the quest for discovering why these events occurred and chalk them up to synchronicity or coincidence? I think such a conclusion would be premature, especially since archaeologists – who are well represented in this volume – are really only beginning to undertake serious research into all the relevant issues. In effect, the authors of the chapters in this volume represent an entirely new generation of researchers who are asking new questions (why did highly mobile hunter-gatherers make pottery in some of the most unsuitable environments for ceramics?), utilizing new techniques (residue analysis, isotopes, phytoliths, pollen, starch grain analysis, analysis of fire cracked rock), tying residue and faunal data to isotopic indications of diets, examining specific contexts, situating pottery use within regional exchange networks and using new analytical frameworks such as design theory (whether implicitly or explicitly). The result has been nothing short of revolutionary in the ceramic world. I continue to wonder whether DNA can be extracted from pottery or stone bowl residues, and if so, what more remarkable information about past uses such analyses might reveal, including about brewing.

CURRENT PROGRESS

The editors of this volume have performed a very insightful job of framing the issues and problems, and of bringing many of the key researchers together at the conference symposium that served as the springboard for this book. They sought to identify patterns in order to deal with the questions of how and why pottery was used in the north. However, with several exceptions, the patterns have been elusive, or at least are inconsistent. Moreover, it is important to recognize that a considerable time range is represented by the studies in this volume, from very early occurrences, c. 18,000 years ago, to more recent introductions c. 3,000 years ago in the Arctic and Boreal zones of North America. Over this 15,000 year time period, pottery undoubtedly evolved and new uses were discovered for the application of ceramic technology. No storage jars, finely made serving vessels or oil lamps occur in the very earliest assemblages, but they do occur later in time.

In addition, conditions undoubtedly changed as well, particularly in terms of cultural complexity and exchange. Thus, as Gjessfeld intimates, oil production after 2000 BP in the remote Kuril Islands may have been largely for export and trade, but could this also have been a motive for initially occupying the Kuril Islands and for adopting pottery in earlier times or in other locations such as Central Sweden, as discussed by Isaksson et al.? During the Pitted Ware occupations in central Sweden, groups were clearly in contact with Funnel Beaker communities whose members could have easily created a demand for fish oil or marine mammal oil either for consumption or lighting. Such an exchange demand for oil could have made large-scale oil production profitable and made pottery an efficient means of processing oil on larger scales. Sustained exchanges could also explain the gradual adoption of Funnel Beaker features by Pitted Ware groups. If groups were favorably situated for producing oils, they could have used the first pottery to produce oils for exchange much as furs were used in historic and contemporary times. Oil consumption would not be traceable with carbon isotopes based on protein or DNA remains.

Perhaps production of oil at the confluence of the Karenga and Vitim Rivers in Siberia, as described by Vetrov and Hommel, could have been for exchange with more complex cultural groups and larger-scale production was facilitated by the use of ceramic vessels. In this case, the producing groups might not need to exhibit any marked degree of complexity, although the groups acquiring the oils would be expected to display feasting or other complex social behaviors. Certainly, the production of fish oils for trade was a major feature of ethnographic Northwest Coast groups who carried this highly valued feasting food along “grease trails” to interior groups. However, this scenario for the Late Pleistocene in Siberia is speculative. The important point is that conditions may have changed over time, the functions of pottery

may have changed over time, and depending on when pottery first appeared in an area and what the conditions were, these may not fit patterns or models of the earliest developments of pottery.

For the earliest (and many later) appearances of pottery among northern hunter-gatherers, the arguments presented in this volume boil down to two main models of causality that form a theoretical dialectic:

- 1) Pottery was necessary for – or at least greatly facilitated – existence in extreme environments like the high arctic (e.g., for cooking, light and heating or lipid extraction or rendering animal fats into oils) as described in chapters by Admiraal and Knecht, Anderson, and Frink and Harry. But then, one wonders how people survived in these areas before pottery was adopted, and why early occurrences in Siberia and Japan involved very limited numbers of pots over many millennia?
- 2) A second type of model for the earliest development (and in some cases later adoption) of pottery in the north postulates that it was adopted in order to prepare highly valued foods for use in sociopolitical strategies, especially in feasts or special ceremonies, as argued by Uchiyama, Boyd et al. and Anderson, as well as Taché (2011; Taché and Craig 2015). But then some of the earliest pottery contexts in Siberia do not seem to reflect levels of complexity commensurate with ideas about feasting.

In addition to these positions, there are researchers who do not endorse any model of causality as with Vetrov and Hommel, and Deal et al.

Certainly one of the most striking patterns of the earliest occurrences, as well as many later adoptions, is the association between pottery and aquatic resources. However, fish can be eaten raw or roasted, and cooking can reduce the nutritional value of marine mammal flesh, as Anderson points out. So, what was the practical value of boiling aquatic resources, especially where fuel was scarce? Appeals to better flavor or gustatory traditions seem unsatisfactory given the difficulty and cost of manufacturing pottery or stone bowls in northern environments as documented by the editors, Admiraal and Knecht, Frink and Harry, and Anderson. The extraction or refining of lipids in the form of soups or oils seems to be the most viable reason for using pottery at least in conjunction with the *mass harvesting* of aquatic resources. Admiraal and Knecht note a strong association between pottery in the Arctic and reliance on marine fish and/or mammals, although Spencer (1959: 473) thought that maritime Eskimos preferred wooden tubs for processing fish. A similar strong relationship between early pottery and aquatic resources has been established for Japan (Uchiyama; Craig et al. 2013), for Early Woodland pottery in eastern North America (Taché and Craig 2015) and perhaps even for pre-agricultural pottery in the Sahara (Garcea 2006: 213). Lipids were highly valued for their caloric contributions and their role in digesting proteins. These are especially

important considerations in the north where the winters are cold, and carbohydrates (lipids or starches) are limiting factors for digestion and maintaining body temperatures. As such, lipids were ethnographically foregrounded in northern prestige contexts, both within local community feasts, as well as serving as a major commodity in exchange relations between groups. The famous use of fish oil at potlatches and the creation of the well-known “grease trails” for the exchange of oil between coastal and inland groups along the Northwest Coast of North America provides dramatic ethnographic documentation of this high value. The same use of pottery for preparing high value prestige foods has been advanced for the use of starch-rich foods such as maize (documented by Boyd et al.) and for the production of nut oils (Taché 2011). In the Near East, the first pottery was similarly used for rendering and/or storing animal fats, but not clearly for cooking (Hodder 2006: 49, 53–4, 83). The non-obvious observation by Boyd et al. that significant amounts of lipids were lost by inserting and removing heated rocks into and out of soups or mashes are important additional factors that need to be quantified and integrated into cost and benefit theoretical models.

Another intriguing pattern that emerged is the long period of very limited use of pottery over several millennia after its initial development (Gibbs, 2015: 348). If pottery provided major adaptive advantages for subsistence, wouldn't one expect a more rapid adoption and expansion of the technology as a major component of subsistence? On the other hand, if pottery was developed for special foods or special circumstances, this pattern would seem to make more sense.

It is at the level of general food strategies such as the use of heated rocks for boiling or rendering, that the emergence of pottery exhibits some semblance of coherent patterning in my estimation. Pottery in the aquatic contexts described earlier makes sense in terms of the development of mass harvesting and processing/extraction technologies during the late Paleolithic and Mesolithic of northern regions. Pottery often develops in tandem with the appearance of mortars and pestles (for crushing nuts or seeds), rock boiling, mass fishing technologies (nets, weirs) and storage facilities for abundant seasonal harvests. The Early Woodland societies described by Boyd et al. (see also, Taché 2011) provide another variant on the same theme since they used pottery for the preparation of other kinds of highly valued foods (maize) in the context of prestige goods, prestige foods, storage, regional exchange, special burials, ceremonial associations with pottery and other characteristics of transegalitarian complexity. The same use of pottery for highly valued foods appears plausible for the Incipient Jomon sites with pottery (Uchiyama), and some Eskimo groups (Anderson). The case of early pottery along the Vitim River in Siberia appears as an outlier that does not fit this pattern very well other than its association with important aquatic resources. One is left to

wonder if this really is a different kind of development or whether future research may change views of the cultural contexts in this region. In the case of the Incipient Jomon discussed by Uchiyama, the simple recovery of a few tuna/bonito remains (at a site which was at the time at least 10 km from the coast) profoundly changes our understanding of the maritime abilities and subsistence activities of these people 11–12,000 years ago. The successful offshore capture of such large fish implies much more sophisticated fishing abilities than previously assumed, and probably indicates even earlier origins for effective fishing, plausibly from the very beginning of the Jomon and the first development of pottery. One wonders if a similar game-changing discovery in the Vitim watershed might not also occur in the future.

FUTURE RESEARCH PROSPECTS

Chapters by Frink and Harry, Admiraal and Knecht, Gjesfjeld, Anderson, and Deal et al., implicitly adopt a design theoretical approach (see Horsfall 1987; Hayden, 1998) by examining the *costs* and *benefits* of pottery production, especially in the context of *tasks* to be performed and *alternative ways* of achieving those tasks, whether by use of baskets, bark containers, stone bowls, wood bowls, hide vessels or non-container alternatives (e.g., roasting, raw consumption). It would be interesting to apply the insights gained from the examination of pottery in the north to other areas where hunter-gatherers used stone bowls prior to adopting pottery such as California, the southeastern United States and the Near Eastern Late Epipaleolithic. Since the costs and constraints of pottery production were considerable in the Arctic and Kuril Islands, it follows that the benefits of pottery use must have been commensurate or greater than the costs. What those benefits were is still not clear, but appealing to better taste or gustatory traditions does not seem like a commensurate benefit to me.

The discussions concerning the change from well-made, well-fired, thin-walled pots with pointed bases to poorly-made, poorly-fired, thick-walled, flat-bottom pots in the Arctic is addressed especially well by the three papers dealing with Alaska and the Canadian Arctic (Frink and Harry, Anderson, and Admiraal and Knecht). The suggestions that a change of function may have been behind this change in pottery is intriguing and plausible. In addition to Anderson's suggestion that early pottery may have been primarily for ceremonial use, I might suggest that a shift could have occurred from the preparation of soups (as high-valued foods) in pointed pottery forms, to a later dominant use of pots for rendering blubber into oil. The implicit use of design theory concepts provides important approaches for understanding pottery developments in these papers, but the approaches can be further refined and augmented by adopting a more explicit design theoretical approach and dealing

with all design factors as outlined in Hayden (1998). These authors have begun the process, but it could be improved by developing the advantages and disadvantages for each alternative strategy (stone bowls, wood bowls, hide or bark containers and non-container strategies). This would be critical not only in understanding why pottery was adopted by certain northern groups, but as several authors have emphasized, understanding why pottery was not adopted or used by other contemporaneous sites or groups in the north, issues raised by Uchiyama, Vetrov and Hommel, Admiraal and Knecht. If pottery was primarily used for producing oils, the availability in abundance of lipid-rich fish or animals (as well as other factors such as availability of clay, soapstone and wood) may be key factors in explaining distributions as suggested by these authors. Mobility may not be as much of a constraint as sometimes assumed since pottery could have been cached at repeatedly used sites as suggested by Deal et al. The use of smaller vessels containing about a liter of liquid, noted by Vetrov and Hommel, Uchiyama, Deal et al., Anderson, and Admiraal and Knecht, need to be explored further. Were these for reheating oils (solidified in winter) or for consumption of soups in individual portions (as perhaps used in the later, more elaborate Jomon pots), or were they really used for initial processing of foods on small scales? The reporting of pottery vessels 100–200 cm in diameter by Anderson is exceptional and baffling, especially given the production constraints noted by chapters dealing with the Arctic. As outliers, they should be dealt with as special but very interesting cases.

While the ethnographic literature of northern groups concerning pottery use seems to have been covered fairly thoroughly, this should be expanded to include the study of other container technologies of fiber, bark, wood, stone and skin, as well as important ethnographic accounts of lipid extraction, value, scale and use, especially where containers with capacities of 8–12 liters are involved as part of the process of extraction or refinement. In general, I suggest that more attention needs to be made to the various container sizes represented by pottery and what small versus medium versus large containers imply about the types and quantities of foods being processed for different sizes of social groups, and by implication, the social contexts.

The ethnographies continue to be opaque about precise circumstances under which meat or fish was cooked rather than eaten raw in the north, so that continued experimentation remains a fertile area to pursue in future research. A similar situation was reported in California where pottery vessels were used for cooking, but “their purposes must have been special, since the ordinary cooking of the Yokuts is as regularly performed in baskets as among other groups” (Kroeber 1925: 537). Anderson’s reading of the ethnographic record concerning the ceremonial use and status of pottery in the Arctic is particularly revealing in this regard, and may form the basis for a radical reinterpretation of Arctic pottery. The conclusions concerning thin-walled

vessels with pointed bases for direct heating versus thick-walled, flat-bottomed vessels for stone boiling are particularly insightful, as is the critical observation by Gjesfjeld that rendering blubber is best undertaken at temperatures of 60–88 degrees, and that stone boiling is best for controlling temperatures below boiling points. The determinations of the nutritional value of uncooked meat compared to cooked meat, as well as the experimental studies of the comparative heating efficiencies of soapstone bowls versus clay pots undertaken by Frink and Harry, are also fundamental experimental approaches for understanding developments in the Arctic and perhaps elsewhere. One hopes that these research avenues will continue to be pursued.

One poorly developed research area in northern regions involves the transformations of initial pottery roles to subsequent roles. Under the socio-political model of initial pottery development, pottery would have been used first for either serving prestige foods or preparing them, a scenario suggested by Anderson. Once pottery technology was perfected, it could then be adapted to other uses such as daily cooking, lighting or storage. Gjesfjeld creates a false dichotomy between pottery used for feasting (only finely made serving wares), and pottery used for normal cooking (only coarse wares). Like Pearson (2005), he fails to take into account the fact that pottery used to prepare special foods for feasts would not need to exhibit finely made characteristics and could superficially resemble ordinary cooking vessels.

In contrast to the socio-political model of pottery evolution, the subsistence model for the origins of pottery postulates that initial pottery was utilitarian and once the technology was developed for basic needs, it later was refined and adapted for use in prestige contexts for prestige purposes. Whichever pathway one favors – the socio-political or the subsistence origins – the trajectory of added functions from initial development to historic varieties of use should be carefully charted.

Integrating DNA analysis into the study of residues should also be a future priority, not only for pottery, but also for fire-cracked rock and stone vessels. The issue of nut oil production needs to be examined in greater depth, especially in cases where vegetative markers are present in pottery residues. Questions as to how pollen became incorporated into any residues also need to be addressed, since mature dry grains traded from distant locations theoretically should not have contained any pollen, which only occurs in the very earliest stages of plant flowering rather than with ripe seeds.

In sum, this is an exciting time to be doing research into the early development and use of pottery by hunter-gatherers in the north. The chapters in this volume epitomize that excitement and have made a valuable contribution to the entire discipline, especially for understanding fundamental features of basic technological changes, with implications that extend far beyond northern regions.

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